The Way Ahead— Maximizing Today's Readiness...Building Tomorrow's Fleet

Keeping America's Navy #1 in the World

Year in Review 2000

The Way Ahead—

Maximizing Today's Readiness...Building Tomorrow's Fleet

NAVSEA

NAVAL SEA SYSTEMS COMMAND

Keeping America's Navy #1 in the World

Aircraft Carriers

Expeditionary Warfare

Mine & Undersea Warfare

Submarines

Surface Strike

Theater Surface Combatants

YEAR IN REVIEW 2000

CALENDAR YEAR 2000

The Way Ahead— Maximizing Today's Readiness, Building Tomorrow's Fleet

2000 was a milestone year in many ways. It was a digital millennial marker that created the Y2K flurry and fizzle. For some it ushered in a new millennium, while the purists waited for 2001 to celebrate.

Regardless of which milestones you celebrated, 2000 was a special year for NAVSEA contributing to Fleet readiness, while sojourning along its corporate path to unity and accelerated change. Focused on day-to-day maintenance, repair and support of Fleet ships and systems, NAVSEA rapidly responded to Fleet needs when USS *Cole* was attacked. This was a complete corporate response, led by PEO Theater Surface Combatants, and supported by the entire NAVSEA Team.

We began the year with a new, unifying logo, which was amplified with an inspiring Corporate Value Statement— ***Keeping America's Navy #1 in the World***. These unifying banners gave form and fashion to the real performance and work of the NAVSEA family in the naval shipyards, the SUPSHIPs, the warfare centers, and the Headquarter elements and affiliated Program Executive Offices. The NAVSEA commands quickly embraced the emblems, highlighting them at symposia and special events like Portsmouth Naval Shipyard's 200th anniversary.

Key to NAVSEA's accomplishments in 2000 was updating our Corporate Strategy to reflect our progress since 1997. With our new value statement, we anchored our Corporate Strategy on four principles—Think Fleet, Workforce Excellence, Corporate Teamwork, and Principled Leadership. These pointed to our seven strategic goals:

- **People**—The best people doing the right job.
- **Customers**—Customer service, second to none.
- **Knowledge Management**—The right knowledge for the right people at the right time.
- **Business Processes**—Excellence, innovation, and continuous improvement to attain the best results at the lowest prices.
- **Engineering**—Disciplined engineering rigor, process, and validation to provide safe, effective, affordable systems.
- **Future Concepts**—Shape the future Navy through robust development and transition of concepts and technology as a continuum across programs.
- **Integrated Product Support**—Effective, timely, affordable integrated product support for the Fleet.

These goals give voice and vision to our approach, which aligns us with the the Chief of Naval Operation's Top Five priorities and focuses our attention on NAVSEA's Critical Few initiatives.

Throughout 2000 NAVSEA's Critical Few initiatives were planned, discussed and pursued, especially at each of the Commander's Forum sessions. With the Fleet participating at these forums, NAVSEA honed its corporate focus with laser precision on organizational and Fleet issues. These critical initiatives included: unifying the NAVSEA Corporation; identifying our core equities (critical skills and capabilities to the Nation); overhauling 31 submarines in 7 years (the Submarine Factory concept); delivering a maintenance Enterprise Resource Planning (ERP) system; implementing the Navy Marine Corps Intranet, adopting improved processes and e-Business (e.g., our Distance Support effort); and improving Fleet modernization to maintain a modern, capable force. All this was aimed at forging strong bonds with the Fleet and a stronger, more capable NAVSEA organization.

From these forums, we have moved from theoretical consideration to solid business planning and performance metric development. Daily we see results from this business-like performance with new and better processes, products, and customer relationships.

Also during 2000, the 27th CNO, Admiral Vern Clark, assumed command and outlined a vision of his Top Five priorities—People, Current and Future Readiness, Quality of Service, and Navy-wide Alignment. Speaking to Commander's Forum XI, he cogently outlined the challenges before us, underscoring the importance of understanding "real requirements," the impact of not meeting them or the technical standards they require, and the need to clearly state them and their funding. He emphasized that this is the only way to operate and develop a capable Navy.

The CNO commended NAVSEA saying, "You have shown the courage to ask your customers and make a true self-assessment." While praising us for "taking on the tough tasks," he both cautioned and challenged that NAVSEA must know the costs of meeting requirements and leading process efficiency improvements.

In the new millennium, we are continually striving to provide our Fleet customers with "service, second to none" and to be the Navy's leader in supporting the Fleet. The information in *Year in Review 2000* is but a short summary of NAVSEA's many successes, programs, and initiatives. In this publication, we can only give you a snapshot of the total impact of our world-class organization. However, it is a good presentation of the NAVSEA professionals who are working hard to support the Navy of today, build the Navy of tomorrow, and engineer the Navy after next. After reading this summary, you no doubt will agree that NAVSEA is working hard at ***Keeping America's Navy #1 in the World!***

G. P. Nanos, Jr.
Vice Admiral, United States Navy
Commander, Naval Sea Systems Command

The NAVSEA Team

The Naval Sea Systems Command (NAVSEA) is the U.S. Navy's ship-systems program manager, engineer, and technical authority. Presently located in Arlington, Virginia, NAVSEA will complete the move to its new home at the historic Washington Navy Yard in Washington, D.C., in summer 2001.

NAVSEA relies upon more than 46,000 Sailors and civilians, along with thousands of private industry contractors, to engineer, build, and support the U.S. Navy's ships and combat systems. NAVSEA's team of engineers, naval architects, scientists, technicians, craftsmen, and staff manages more than 130 acquisition programs. They provide engineering support, technical authority, and logistics support to the Fleet. This team includes six affiliated program executive offices, four Naval shipyards, nine supervisors of shipbuilding, two warfare centers, the Naval Ordnance Safety and Security Activity, the Naval Sea Logistics Center, headquarters operations, and a number of smaller organizations. NAVSEA also administers more than 1,200 foreign military sales cases involving 65 countries and four NATO organizations, worth more than $17 billion.

NAVSEA is the largest of the five U.S. Navy system commands. Its fiscal year 2000 budget of $15.1 billion accounted for nearly 17 percent of the Navy's $88.7 billion budget, while its fiscal year 2001 budget of approximately $18.8 billion budget accounts for approximately 20.1 percent of the Navy's $93.5 billion budget. Such budgets place NAVSEA among the United States' top business enterprises when comparing the value of assets, number of employees, and total budget using *Fortune* magazine criteria.

Program Executive Offices

NAVSEA's six affiliated Program Executive Offices (PEOs)—Aircraft Carriers, Surface Strike (formerly DD 21), Expeditionary Warfare, Mine and Undersea Warfare, Submarines, and Theater Surface Combatants—are responsible for all aspects of life cycle management for their assigned programs. NAVSEA provides the PEOs with total ship system engineering, establishes and coordinates technical policy and procedures, and delivers integrated logistics support. The PEOs report directly to the U.S. Assistant Secretary of the Navy for Research, Development, and Acquisition (ASN RD&A) for designated acquisition matters. They report to NAVSEA for planning and execution of life-cycle support.

Naval Shipyards

The four geographically dispersed Naval shipyards—Portsmouth, Norfolk, Puget Sound, and Pearl Harbor—serve as the very core of the Navy's industrial infrastructure and are responsible for the maintenance, modernization, inactivation, disposal and repair of U.S. Navy ships and submarines of the Fleet. NAVSEA's highly skilled, industrial shipyard personnel give the Navy a unique capability to repair and overhaul U.S. Naval ships and specifically nuclear-powered vessels. Workers from the Naval Shipyards bring their expertise to wherever Fleet requirements exist, from emergent repairs occurring worldwide, to dry docking submarines and aircraft carriers at the shipyards themselves, doing so with quality, cost efficiency, and timeliness.

NAVSEA team members describe the Integrated Power System test facility to Secretary of the Navy Richard Danzig at NAVSEA's NSWC Philadelphia. Looking on is Vice Admiral G.P. Nanos, Jr., NAVSEA's Commander.

Supervisors of Shipbuilding, Conversion, and Repair

Supervisors of Shipbuilding, Conversion, and Repair (SUPSHIPs) serve as the Department of Defense's designated contract administrators for shipbuilding and repair contracts. Located near private shipbuilding facilities throughout the United States, the nine SUPSHIPs—Bath, Maine; Groton, Connecticut; Jacksonville, Florida; New Orleans, Louisiana; Newport News, Virginia; Pascagoula, Mississippi; Portsmouth, Virginia; Puget Sound, Washington; San Diego, California; and SUPSHIP San Diego Detachment Pearl Harbor, Hawaii—act as NAVSEA's on-site technical, contractual, and business agents. Working side by side with the shipbuilders, these agents are instrumental in bringing each new ship from the drafting table to the Fleet, and ensuring a ship's health and technical superiority throughout its service life. In fiscal year 2000, SUPSHIP personnel supervised the completion of 73 CNO scheduled repair availabilities, 66 percent of which completed early or on schedule. The SUPSHIPs also provided oversight on three ship commissionings, eight ship deliveries, eight launchings, and five keel layings, as well as the delivery and repair of hundreds of smaller repair packages.

Naval Surface Warfare Center

The Naval Surface Warfare Center (NSWC) is comprised of five divisions—Carderock Division (with locations in Bethesda, Maryland, and Philadelphia, Pennsylvania), Crane Division (Crane, Indiana), Dahlgren Division (with locations in Dahlgren, Virginia, and Panama City, Florida), Indian Head Division (Indian Head, Maryland), and Port Hueneme Division (Port Hueneme, California)—and the Naval Warfare Assessment Station in Corona, California. NSWC is the Navy's principal research, development, test, and evaluation activity for surface ship combat systems, ordnance, mines, and strategic systems support. As such, it performs warfare analysis, research, design, development, test, evaluation, assessment, system integration, strategic missiles systems support, special and amphibious warfare support, and Fleet engineering services.

Naval Undersea Warfare Center

The Naval Undersea Warfare Center (NUWC) has two divisions: Division Newport in Newport, Rhode Island, and Division Newport in Keyport, Washington. NUWC is the Navy's full-spectrum research, development, test, evaluation, engineering, and Fleet support center for submarines, autonomous underwater systems, and offensive and defensive weapons systems associated with undersea warfare. NUWC is a leader in undersea warfare modeling and analysis, submarine combat and combat control systems, surface ship and submarine sonar systems, submarine electronic warfare, submarine communications, submarine weapons systems, undersea ranges, torpedoes, and torpedo countermeasures.

Naval Ordnance Safety and Security Activity

The Naval Ordnance Safety and Security Activity (NOSSA) is located in Indian Head, Maryland. Its mission includes publicizing and enforcing Navy explosives safety and ammunition physical security policy, directives, and standards; acting as the Navy's technical authority for explosives safety and as the principal authority on all matters related to naval ordnance transportation, safety, and security worldwide; developing and implementing the Navy explosives safety program; and providing support to the Navy ordnance environmental program.

Naval Sea Logistics Center

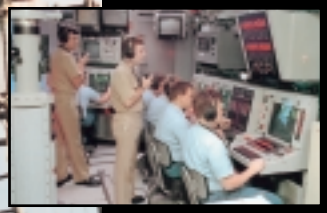
The Naval Sea Logistics Center (NSLC) consists of four divisions and seven small on-site offices located throughout the United States. It specializes in providing integrated logistics, engineering, and information technology expertise to meet the needs of its worldwide customer base, and features hands-on management of various logistics business processes along with customized consulting services on the development and implementation of logistics information technology enabling tools. NSLC provides a range of products and services to all facets of the Navy's logistic support structure, including the operating Fleet, the Department of the Navy Secretariat, and the Office of the Secretary of Defense.

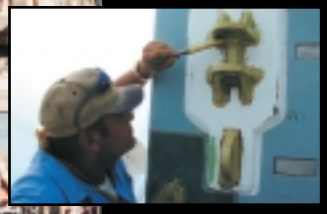
Naval Reserve Program

NAVSEA's Naval Reserve community is a highly skilled and talented workforce that provides experience and perspectives that NAVSEA can leverage in performing its mission. Reserve personnel provide diverse core competencies that meet a variety of mission requirements, including waterfront support, the donated ship inspection program, and the environmental safety historical information program. While the Naval Reservists accrue valuable mobilization training, they are able to apply their unique skills and best commercial practices from their civilian job experiences to the military and industrial environments, and they effectively contribute the latest industry ideas to the development of the NAVSEA business model.

Naval Sea Systems Command

Quality of Service for Today





A Submarine undergoing maintenance at Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility

NAVSEA

NAVAL SEA SYSTEMS COMMAND

Keeping America's Navy #1 in the World

NAVSEA's nearly 46,000 professionals strive for continuous improvement in cost and performance to enhance current Fleet readiness. Knowing and understanding requirements, working to meet them, and controlling cost in delivering them are all needed to operate and develop a capable Navy.

Work Practices

Capital Investment for Labor

Corrosion control, commonly known in the Fleet as "chipping and painting," and other organizational-level maintenance on U.S. Navy ships consume vast amounts of maintenance dollars and manpower. They also negatively affect the Sailor's quality of life. Fleet Sailors devote nearly 16 man-years to painting and preservation per ship. This culture of Sailor labor in preservation is changing.

NAVSEA's Capital Investment for Labor program (CI Labor) is a series of initiatives, each with the goal of reducing Sailor workload. CI Labor has delivered many successes and expects more in coming years. Sailors now benefit from programs that apply the best technology to improving quality of service and quality of life. These programs include advanced coating systems that have better preservation characteristics and last longer; updated tools, equipment, and mechanical components that make the work go faster; and improved processes and designs that significantly reduce the amount of labor required. CI Labor's most notable successes of 2000 included:

Preservation teams. Two preservation teams began the demonstration project; a total of eight teams were working by the end of the year. During that time, the teams worked on 50 ships, covering over 130,000 square feet with advanced coating systems. Total workload reduction for the first year's effort was calculated to be approximately 100,000 Sailor-hours per year; the total cost avoidance realized was over $250,000. Fifteen teams are slated to work on approximately 70 ships in 2001.

A student at Palomar High School in San Diego, works aboard USS Fitzgerald *(DDG 62) at a Naval Base in San Diego. The NAVSEA preservation teams joined with SIMA San Diego to support this vital program that gives high school students work experience and vocational training.*

Stainless Sanitary Space System (S^4). The S^4 is a complete shipboard sanitary space designed to extend service life, improve habitability, and reduce cleaning workload. The S^4 will last twice as long as conventional sanitary spaces, and will require about half the time to clean. Projected workload reduction for the Fleet's 3,000 heads is 2,250 Sailor man-years per year when fully implemented; cost avoidance over 10 years will total $375 million. Fifteen spaces will be installed in 2001.

DEC (Durable, Easy-Care) tile. The service life of DEC tile is twice that of vinyl tile currently found in the Fleet. Additionally, this tile requires no waxing, buffing, stripping, or resealing during its 10-year service life. The tile comes in attractive wood grain and stone finishes, and enhances the appearance of spaces while reducing the workload to keep them clean. Over 150,000 square feet of DEC tile has been installed on 51 ships. These installations alone will yield a cost avoidance of nearly $300,000 per year, and a workload reduction of 186 man-years per year. Additionally, the lightweight tile has reduced shipboard weight by more than 275,000 pounds.

Shipboard Electroplating Process

As a result of process improvement efforts by Portsmouth Naval Shipyard, a new electroplating methodology was introduced for use on USS *La Jolla* (SSN 701). The new process uses portable equipment and special tooling to apply a chemical solution. Instead of being applied in open air, the solution is applied in an enclosed environment. The need to grind applied surfaces is greatly reduced due to increased control over application thickness; any grinding still necessary can be done within the contained apparatus. The new process saves time, uses expensive chemical solution efficiently, creates less hazardous waste, requires less physical clean up, and is less fatiguing and dangerous for workers. A conservative estimate of annual savings is $1.5 million.

Plural Component High Solid Painting Process

The use of plural component high solid paint improves the paint system's overall effectiveness and reduces submarine preservation overall total ownership cost. The paint is applied with plural component equipment. While this technology has been used in the private sector, it is only now being introduced into public Naval Shipyard submarine maintenance. Portsmouth Naval Shipyard used this process exclusively for all seawater tanks and free-flood areas onboard USS *San Juan* (SSN 751), and experienced significant reductions in man-hours material expenditures.

Safe Acid Cleaning Process

Puget Sound Naval Shipyard completed the cleaning of the entire auxiliary sea water system on USS *Olympia* (SSN 717) using the new Safe Acid Cleaning Process. Using this process realized an estimated savings of $434,603 over the conventional cleaning method. The Shipyard has taken the lead in the develop-

ment of this new process for cleaning sea growth from ships systems. The process uses a commercial descaler that is circulated through a ship's component or system, dissolving the sea growth or any other calcification that occurs during normal operation.

Sub School Sailors train with an Acoustic Rapid COTS Insertion (ARCI) system.

Smart Carrier

The Smart Carrier Project is the cornerstone of the aircraft carrier evolutionary strategy. The project goal is to improve quality of life for Sailors while reducing workload in the in-service carrier fleet by 15 percent, and by providing a transitional path to future carriers whose ultimate workload reduction is targeted at 50 percent. The program strategically focuses on workload reduction through policy/procedure review, industry-standard process reengineering, and the insertion of enabling technologies. A prototype of these efforts is being installed aboard USS *John C. Stennis* (CVN 74).

SMARTSHIP

The SMARTSHIP installation occurred in the summer of 2000 on USS *Monterey* (CG 61). SUPSHIP Portsmouth assumed the role of naval supervising activity and provided the coordination between the two prime contractors, Marine Hydraulics International and Litton Guidance Control System. This 5-month project encompassed 12 different organizations totaling a workforce of approximately 400 contractors working to complete the work within a 20-week window.

Documentation/Training

Force Protection Allowance Equipage List Material

The terrorist attack on USS *Cole* (DDG 67), underscored the need to protect U.S. Navy ships. The Chief of Naval Operations identified Force Protection Allowance Equipage List (AEL) Material as one of the Navy's highest priorities in 2000. Congress added $12 million to the Navy budget for force protection material for fiscal year 2000 and $18 million for fiscal year 2001. NAVSEA is responsible for utilizing these funds to outfit all Navy ships with specific items that will assist shipboard security forces in thwarting potential terrorist attacks.

Force protection AEL material is a compilation of security/antiterrorism related items including the operational equipment needed for outfitting Navy security watch standers at pier, gate, and perimeter posts to protect themselves and the ship. Specific items for the list were selected after extensive coordination with working groups from Fleet commanders-in-chief, the Naval Criminal Investigation Service Law Enforcement, and physical security staff, and include body armor, ballistic helmets, tactical vests, range finders, night vision devices, spotlight kits, bolt cutters, handheld metal detectors, megaphones, binoculars, handcuffs and leg irons, inspection mirrors, batons and whistles, pepper spray and floggers, and first-aid kits. Based upon the *Cole* incident, explosive detection devices will be added to the AEL.

Battle Force Intermediate Maintenance Activity Training

In 2000, NAVSEA's Battle Force Intermediate Maintenance Activity Training program taught 303 intermediate level hull maintenance and equipment repair skills courses on 27 different topics for Sailors on large-deck ships (i.e., CV/CVN and LHA/LHD), tenders, and shore intermediate maintenance activities. Fleet units requested the courses in support of their Navy Afloat Maintenance Training Strategy skill qualifications. Topics included air conditioning and refrigeration, EPA ozone-depleting substance technician certification, machinery shaft alignment, electrical equipment repair, piping fabrication, and pump repair. In addition, 61 onboard organizational level repair courses, requested by smaller combatant ships preparing to deploy, were taught.

Aegis Training and Readiness Center

NAVSEA's Aegis Training and Readiness Center (ATRC), headquartered in Dahlgren, Virginia, is responsible for the training and readiness of Aegis combat system personnel throughout

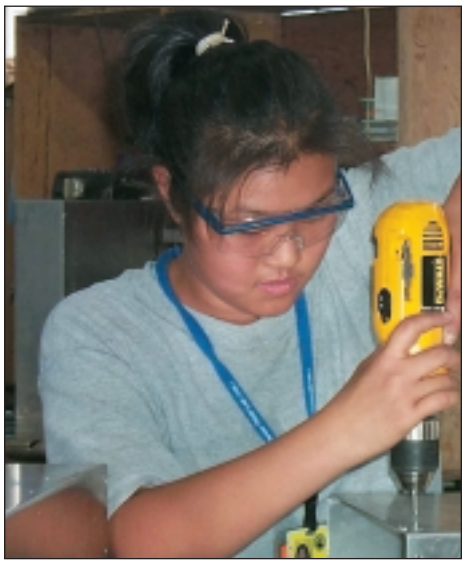
the Aegis Fleet. This includes the Aegis Fire Controlman "C" School, the Surface Warfare Officer Pipeline, waterfront training, acquisition agent, acquisition support, and readiness.

During 2000, ATRC trained more that 13,000 officer and enlisted students, including 24 Japanese Maritime Self Defense Force students, in the operation, maintenance, and employment of the Aegis combat system. ATRC personnel participated in Joint Training Exercise Roving Sands 2000 and Joint Service Training Exercise 2000, as well as in numerous other exercises and training support functions involving Navy, Joint, and Allied personnel. In addition, they worked with various other Navy organizations to develop new training and warfighting systems capabilities. To enhance distance learning efforts, ATRC installed 20 new electronic classrooms at its Dahlgren Schoolhouse, and video teletraining systems and Aegis Scenario Authoring Systems at its seven worldwide detachments.

The ATRC Detachment in Philadelphia has trained more than 1,300 engineering officers and enlisted personnel this year in the operation of the Aegis destroyer's propulsion systems and SMARTSHIP technologies at NSWC Philadelphia's DDG 51 Main Propulsion Land Based Engineering Site, on board ships, and in private shipyards.

Submarine Vertical Launch System Trainers

The Submarine Vertical Launch System Trainer is the latest in a series of trainers developed by NAVSEA's NUWC Keyport to train Sailors to maintain complex weapon and ship-control systems that are impractical to teach onboard. NUWC Keyport worked actively with customers to determine their training needs, and then designed a system around those needs using available surplus assets and creative fabrication techniques. Trainers have been built, installed, and tested at the naval submarine schools in Hawaii and New London, Connecticut, with projected cost savings of over of $7.5 million over eight years.



A shipyard apprentice works and trains at Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility.

Advanced Weld "C" School

Puget Sound Naval Shipyard partnered with Chief of Naval Education and Training at Bangor's Trident Training Facility in May 2000 to open an Advanced Weld "C" School. Moving this training to Puget Sound, Washington, expands training opportunities, reduces costs, and improves Sailors' quality of life. Fleet assignment can be provided for as many as 36 Sailors per year from this site, with a potential savings of over $250,000 per year.

Shipyard Instructional Design Center

NAVSEA's Shipyard Instructional Design Center (SIDC) provides expert technical training on submarine structural closure and ship's propeller systems, including *Seawolf* (SSN 21) and *Virginia* (SSN 774) Class propulsors.

Working closely with Puget Sound Naval Shipyard, SIDC developed Uniformed Industrial Process Instruction training on a new environmentally safer and more efficient sea growth deposit descaling flush using Safe-D-Scale and Rydelyme chemicals. Working with the Naval Shipyard Apprentice Program administrators, SIDC currently is developing a corporate model pipefitter apprentice trade training plan and process for revitalization of the workforce. Also, SIDC's state-of-the-art graphic, video, and photo capabilities are is used extensively by shipyard training departments and the NAVSEA corporation to design a wide array of visual information in support of ship repair, maintenance, and modernization.

Ships and Systems

Refueling Complex Overhaul

Managed by SUPSHIP Newport News, USS *Nimitz* (CVN 68) has nearly completed the second half of her 33-month Refueling Complex Overhaul (RCOH) at Newport News Shipbuilding. *Nimitz's* RCOH is the first *Nimitz* Class aircraft carrier refueling, recapitalizing the ship for another 25 years. This program encompasses refueling the nuclear reactors, recapitalization of material readiness through selected repairs and transition to an Incremental Maintenance Program, and modernization of the ship's warfighting systems. Modernization highlights include installation of the Integrated Communications and Advance Networks (ICAN), which is a shipwide fiber optic based voice and data distribution system; significant upgrade of the combat systems such as Cooperative Engagement Capability; Carrier Intelligence Center suite; and advance planning for Ship Self Defense Systems MK 2 installation.

In January 2000, the Navy awarded an advanced planning contract to Newport News Shipbuilding for the fiscal year 2001 RCOH of USS *Dwight D. Eisenhower* (CVN 69); in October 2000, the Navy issued a Request for Proposal for the RCOH execution contract which will begin in May 2001. USS *Carl Vinson* (CVN 70) is in the midst of strategic planning for her fiscal year 2005 RCOH.

Submarine Maintenance and Refueling

NAVSEA's Naval Shipyards focused on several key areas during 2000, including the Submarine Factory initiative which addresses the upcoming schedule of submarine engineering overhauls and refuelings.

The amount of depot-level submarine work needed over the next five years to keep the Fleet in a high state of readiness is unprecedented: a total of 35 major submarine availabilities (including overhauls, refuelings, and inactivations) need to be accomplished between fiscal year 2001 and fiscal year 2005. The Naval Shipyards will be required to handle most of the effort, as few private shipyards are qualified to perform complex submarine work. Because the Naval Shipyards have scaled down over the last decade in terms of facilities and numbers of personnel, they must employ new strategies to meet the demands of the upcoming workload. The Submarine Factory is the answer to these demands.

NAVSEA's Submarine Factory is a partnership between key players, including the four Naval Shipyards, the two nuclear-capable private shipyards, NAVSEA's Submarine Maintenance Engineering, Planning and Procurement Activity (SUBMEPP), and Submarine Team One, to implement initiatives such as standardization, resource sharing/augmentation, process improvements, and material support programs.

Ship Repair: USS *Denver*

A combined NAVSEA production and engineering effort enabled USS *Denver* (LPD 9) to depart Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility (PHNSY & IMF) in late July 2000 for her homeport in San Diego. An at-sea collision two weeks earlier had left a 40-foot hole in the bow from the second deck to the waterline of the 570-foot amphibious transport dock ship. The West Coast, the Underwater Ship Husbandry Division, the Surface Ship Structural Integrity Division, and PHNSY & IMF worked together to plan and complete the repair. The temporary structural repairs had to be strong enough to withstand the journey and hydrodynamically shaped so the ship could cut through the water at 20 knots.

USS Denver LPD-9 July 14, 2000

USS Denver LPD-9 July 27, 2000

Divers from the Fleet's Mobile Diving and Salvage Unit (MDSU) ONE videotaped the entire underwater hull to aid in the engineering assessment. In addition to the visible damage above the waterline, the stem was split open down to approximately 5 feet below the waterline, with the shell plating peeled outward and torn. Damage below the waterline required the Underwater Ship Husbandry Division and its contract welder-divers to perform underwater repairs. The NAVSEA professionals carefully managed environmental concerns, preventing materials from dropping into the harbor.

The total area repaired on *Denver* was roughly 40 feet high and 24 feet back from the bow. About 54 tons of new plates and beams were installed and held together with 1,300 pounds of welding electrodes (i.e., rods).

Ship Repair: USS *Cole*

On October 12, 2000, USS *Cole* (DDG 67) was attacked by a suicide/terrorist small boat during a refueling stop in the Port of Aden, Yemen. NAVSEA supported the Atlantic Fleet commander with immediate damage assessment, damage control and stability analysis, salvage engineering, technical support, and repair planning.

NAVSEA delivered a complete corporate team response to the *Cole* tragedy. Supporting the Atlantic Fleet, NAVSEA's response was led by PEO Theater Surface Combatants (PMS 400) and supported by another seven NAVSEA organizations working with partners in private industry (i.e., Bath Iron Works and Litton Ingalls). NAVSEA Headquarters engineers and diving and salvage experts worked closely with professionals from Norfolk Naval Shipyard, SUPSHIPs Bath and Pascagoula, and the Naval Ordnance Safety and Security Activity.

Based on the initial damage report, NAVSEA conducted a preliminary longitudinal strength and stability analysis using the Program of Ship Salvage and Engineering (POSSE) software, and demonstrated that *Cole* had satisfactory longitudinal strength and stability. Later, a more detailed survey revealed greater damage than initially reported; more analysis verified no immediate strength and stability concerns.

Engineers and support personnel from Norfolk Naval Shipyard flew to Aden with welding equipment and a "Jaws of Life" system to assist with damage assessment and recovery of remains. Weapons effects specialists from NAVSEA's NSWC, along with NAVSEA engineers, analyzed the safety and survivability characteristics of the ship's missiles and other systems, and supported ordnance offload.

After reviewing all repair options, the Navy decided to

View of damage after terrorist attack on USS Cole *(DDG 67).*

USS Cole *(DDG 67) on the Norwegian merchant vessel* Blue Marlin *en route to Pascagoula, Mississippi, for repairs.*

transport *Cole* back to the United States on a heavy-lift ship; the Military Sea Lift Command contracted for the Norwegian merchant vessel *Blue Marlin* to make the lift. NAVSEA, the Military Sealift Command, and Overseas Heavylift Transport personnel, owners of *Blue Marlin*, worked together to develop the docking plan for *Cole*. The initial lift occurred on October 30. *Cole* began her stateside journey onboard *Blue Marlin* on November 5, and arrived at Litton-Ingalls Shipbuilding in Pascagoula, Mississippi, on December 13 to complete repairs.

Submarine Maintenance and Support

NAVSEA's Submarine Maintenance Engineering, Planning and Procurement Activity (SUBMEPP) reaches worldwide to provide submarine maintenance solutions to ships, intermediate maintenance activities, and depot facilities. Its planning and scheduling products, ready-for-issue component pools, and engineering expertise equip it to meet both the projected and emergent needs of the submarine Fleet. In 2000, SUBMEPP added a second representative to the Atlantic Fleet staff and provided temporary on-site engineering support for the Pacific Fleet staff.

Critical tasks for SUBMEPP in 2000 revolved around support of the Submarine Factory, the Navy's on-going imperative to accomplish more than 35 heel-to-toe submarine availabilities.

In addition, SUBMEPP aligned its internal processes to integrate the maintenance planning needs of existing submarines with requirements for the new *Virginia* (SSN 774) Class and the follow-on submarines of the 21st century. The consolidation of its maintenance standards program led the effort to support all new and existing platforms with the same set of human and technology resources. Other consolidation initiatives fueled the developmental work which will allow SUBMEPP to begin rollout of its Maintenance and Ship Work Planning (M&SWP) system early in 2001. M&SWP will support every submarine in the Navy—from the oldest hull to keels yet to be laid—with a single process, and will provide one secure interface for the Fleet and depot customers today and into the future.

The drydock *Sustain* at Atlantic Dry Dock, Inc., Jacksonville, Florida. Certified for use in May 2000, *Sustain* provides a repair capability absent in the area since 1992. Supervised by NAVSEA's SUPSHIP Jacksonville, the drydock docked six vessels in 2000 including USS *Spruance* (DD 963) and USS *Underwood* (FFG 36) for scheduled repair availabilities.

Nuclear Regional Maintenance Department

Beginning in April 2000, SUPSHIP Groton coordinated the preparations for the "first-ever" Nuclear Regional Maintenance Department (NRMD) using a private contractor. This direct Fleet support activity will be located in the newly constructed controlled industrial facility at the Naval Submarine Base New

London, Connecticut, and will provide services to 18 fast attack submarines, the research vessel NR-1, and the historic ship *Nautilus*.

Electric Boat Corporation was selected as the prime contractor. A detailed and aggressive implementation plan was developed based upon the successful establishment of NRMDs at other shipyards, and the targeted initial stand-up of dosimetry and radiation monitoring starting in January 2001. When in full service by spring 2001, the new NRMD will provide project management, planning, training, and radiological control services to accomplish nuclear submarine maintenance, modernization, and repairs, along with related base support functions. One of its most unique aspects will be the integration of 19 Electric Boat nuclear managers, planners, and trainers; 76 full-time, active duty Navy personnel; and specialized surge trade skill personnel from Portsmouth Naval Shipyard and Electric Boat's Groton shipyard.

Torpedo Depot Work. A NAVSEA NUWC Keyport torpedo maintenance depot employee works on an MK 48 afterbody assembly. NUWC Keyport delivers high-quality heavyweight and lightweight torpedoes to the Fleet on budget and on time.

Reduced Crew Size Calibration and Maintenance Tool

The Naval Warfare Assessment Station (NAVSEA Corona), through the Metrology Research and Development Program, developed the Reduced Crew Size Calibration and Maintenance Tool (RCS-CMT) system to reduce shipboard maintenance labor hours for supporting hull maintenance and equipment systems by eliminating or automating steps in the maintenance and calibration of shipboard installed instrumentation. With the RCS-CMT approach, the maintenance technician uses a wearable personal computer (PC) as an electronic book for viewing web-based maintenance cards. A smart button reader is attached to the wearable PC and serves as a data collection system to identify the unit under test. A portable standard pressure calibrator is automated by the PC for semi-automated pressure gage calibration, and a wireless local area network allows the computer to serve as a communication tool to provide Distance Support, embedded training, and the ability to transmit data collected during maintenance.

Battle Force Self-Sustainability

With tenders no longer available as deployed assets, NAVSEA has responded to Fleet requirements to enhance the maintenance and repair capabilities of Battle Groups and Amphibious Readiness Groups. Working with Fleet Type Commanders, Ship's Force, and Battle Force maintenance coordinators, NAVSEA provided technical support to identify afloat maintenance capability and equipment requirements; updated maintenance capability standards for carriers (CV/CVN), assault ships (LHA, LHD), cruisers (CG), destroyers (DD, DDG), frigates (FFG), fast combat support (AOE), transport docks (LPD), and dock landing (LSD) ships; and conducted an assessment of USS *Inchon* (MCS 12) to set a standard for mine countermeasure support (MCS) ships. To correct shortfalls, NAVSEA installed Alterations Equivalent to a Repair (AER) to upgrade and standardize maintenance shop capabilities. During 2000, installation of AERs were completed aboard USS *Harry S. Truman* (CVN 75), USS *Carl Vinson* (CVN 70), USS *Kearsarge* (LHD 3), and USS *Boxer* (LHD 4). NAVSEA plans to execute four installations per year, as scheduled by the Fleet, until all the carriers and large-deck amphibious ship upgrades are complete.

Expeditionary Warfare Life Cycle Support Program

NAVSEA and PEO Expeditionary Warfare established the Life Cycle Support Program Management Office in June 2000 to be more responsive to the Fleet and to achieve efficiencies through standardized ship maintenance and modernization processes based on e-business concepts. The program provides life cycle management and modernization for all in-service amphibious, command, and auxiliary ships, and in-service floating dry-docks for the U.S. Navy. It supports in-service ships by providing timely and quality modernization, maintenance, and technical and logistics products and services. Classes of ships supported include amphibious assault ships (LHA and LHD); amphibious landing ships (LPD, LSD, and LST); command ships (LCC and AGF); fast combat support ships (AOE); rescue and salvage ships (ARS); submarine tenders (AS); and floating dry docks.

A number of on-going initiatives will improve the effectiveness of amphibious ships into the 21st century. These include the MV 22 Osprey Ship Integration, the LHA Class Midlife/Stability Improvements, and the LPD 4 Class Sustainability Program

Advanced TOMAHAWK Weapon Control System Logistics Support

During 2000, NAVSEA's NSWC Port Hueneme logisticians provided on-site support for installation of the Advanced TOMAHAWK Weapon Control System (ATWCS) on 21 surface ships in three ship classes. Performed during installation/checkout, this support included documentation updates, support/test

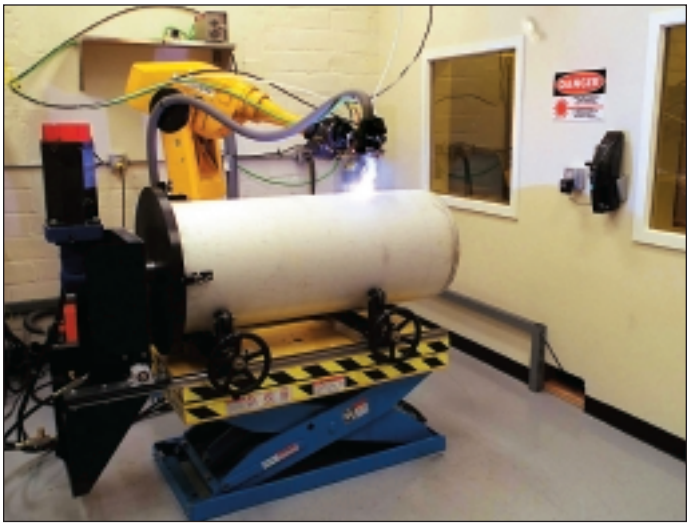
equipment audits, assistance with training and interactive courseware deliveries, and coordination with all shore activities involved in ordering and receiving additional onboard spare parts and maintenance assistance modules to support the ATWCS upgrade for each ship. The on-site logisticians also participated as part of the Cruise Missiles Material Certification Team, conducting a full shipboard certification of all shipboard support functions required prior to missile loadout and deployment. As a result of these efforts, all 21 Tomahawk ships receiving ATWCS in 2000 met the certification requirements for onboard documentation, support equipment, and spare parts.

Miniature Microminiature Module Test and Repair Program

Led by the Logistics, Maintenance and Industrial Operations Directorate (SEA 04), NAVSEA's Miniature Microminiature Module Test and Repair (2M MTR) program continued to be a vital part of the Fleet's core maintenance capability, and made a significant impact on cost avoidance and sustainability of mission critical systems. The use of 2M MTR capabilities resulted in approximately $30 million in cost avoidance and 900 casualty reports averted or corrected. Enhanced 2M MTR capabilities initially introduced in 2000 include the Pinpoint test system and a new 2M rework station. These capabilities will allow the Fleet to repair circuit cards and electronic modules which they previously could not repair. Additional training courses for 2M MTR were established in Pearl Harbor, Hawaii, and in Yokosuka, Japan. Efforts continued to develop high-priority gold disk test procedures and to replace aging 2M MTR equipment with new state of the art replacement equipment.

Laser Applications

All torpedoes issued to the Fleet pass through NSWC Keyport's Torpedo Depot for maintenance, periodic repair, and replacement of parts. Keyport's engineers constantly look for new ways to keep maintenance costs down while increasing quality; the use of lasers for repair of aluminum parts is one way to accomplish this.



A new laser cladding system successfully fuses aluminum powder at NAVSEA's NUWC Keyport.

NAVSEA Keyport partnered with the Applied Research Laboratory, Pennsylvania State University, under the Navy Manufacturing Technology program to develop a repair process for aluminum components called "laser cladding." Laser cladding is a low-heat process that fuses aluminum powder into areas affected by corrosion (and other types of damage) with the use of robotics and an industrial laser beam. Laser cladding processes had been used for other metals, but had not been developed for use on aluminum parts. In the first six months of operation, the use of lasers has paid for the installation of the laser robotics equipment, saved time in repairs, and has dramatically reduced costs and increased quality over former repair processes.

Test and Evaluation

NAVSEA's Test and Evaluation Office has developed mobile testing ranges and brought them to the Fleet, rather then requiring the Fleet to spend time transiting to distant test range sites. By using the latest technology and advanced portable systems, NAVSEA created a surface ship radiated noise measurement range in the middle of the Gulf of Mexico that measured the underwater noise of all the ships in a Battle Group in conjunction with a pre-deployment training exercise. A new prototype mobile Fleet operations readiness accuracy check site system was also developed and tested. This mobile system will be used off Norfolk and other homeports for testing sonar and radar accuracy. The technology allows for increased testing which identifies noise and sensor accuracy problems for correction, and helps improve Fleet readiness.

Cartridge-Actuated Devices and Propellant-Actuated Devices Acquisition Reengineering

Cartridge-Actuated Devices and Propellant-Actuated Devices (CAD/PADs) are the energetic devices that are used in pilot ejection seats. NAVSEA's NSWC Indian Head Division is the U.S. military's single stock point for CAD/PADs and has improved responsiveness to the Fleet customer with a new process that allows the customer to order devices via phone, fax, or e-mail. Resupply lead times in the continental United States have been reduced from 120 to 7 days. In early 2001, a supply process will be in place that reaches all around the world. Customers in Japan, Italy, Bahrain, Iceland, and Puerto Rico will be able to place and verify their orders via the internet.

CAD/PAD energetic devices power pilot ejection seats.

O_2N_2 Plants

In 2000, NAVSEA's NSWC Philadelphia professionals solved systems difficulties for USS *Harry S. Truman* (CVN 75). The crew could not duplicate the oxygen production rates achieved by the original equipment manufacturer during initial installation testing for the shipbuilder despite modification of the feed air compressor. NSWC Philadelphia personnel traced the inability to meet the rated capacity to a malfunctioning liquid oxygen pump (aft plant), crew inexperience, plant leakage, and wet insulation. NSWC Carderock conducted in-port and at-sea grooming efforts, which included ordering a replacement pump, thoroughly training the crew, repairing the plant leakage, replacing the wet insulation, and defining and subsequently correcting ILS issues. The result: the O_2N_2 plant and the air compressor, in both the forward and aft plants, demonstrated the ability to meet rated capacity.

Enhanced TOMAHAWK Effectiveness. TOMAHAWK missile being loaded aboard a submarine. NUWC Newport provides engineering/technical support for the submarine launched TOMAHAWK missile program, including integration support for the newest variant, Tactical TOMAHAWK.

Delay Charge Design, MK 141 Mod 0

NAVSEA's NSWC Crane Division teamed with Pyrotechnic Specialties, Incorporated (PSI), of Byron, Georgia, to improve the design and producibility of the delay charge design in the MK 141 Mod 0 diversionary charge. The original design contained a lead-sheathed delay column where the composition was compacted through a progressive rolling/swaging process; PSI proposed an alternate design of the delay using the same delay composition pressed into an aluminum housing. Through a joint effort, the contractor contributed development and testing of the alternative design, while the Navy led the effort to document the change and gain Weapon System Explosives Safety Review Board concurrence following successful test and evaluation. The new delay change design resulted in reduced production cost, less variation in delay burn times, an overall increase in product reliability, and an elimination of lead particulate emissions. The projected cost avoidance is expected to be at least $250,000 over the next 10 years.

Surface Maintenance Effectiveness Review

NAVSEA's Surface Ship Maintenance Effectiveness Review (SURFMER) eliminates unnecessary or ineffective surface ship preventive maintenance tasks. SURFMER already has achieved a 40 percent reduction in shipboard planned maintenance workload. In 2000, with continuing Sailor and NAVSEA engineers' participation, SURFMER reduced the workload by more than 220,000 man-hours.

In support of the Chief of Naval Operations' Fleet Review Board, SURFMER continued regular reviews in 2000, including adding statements of relevance on Maintenance Requirement Cards (MRCs) that tell a Sailor why it is important to do a particular task; reviewing tools, parts, and consumables to ensure MRCs list only items absolutely necessary to perform PMS; adding emphasis on evaluation of maintenance procedures to simplify tasks and eliminate unnecessary elements; hazardous material and safety requirements; and outsourcing potential.

Integrated Class Maintenance Plans

NAVSEA develops and maintains condition-based maintenance Integrated Class Maintenance Plans (ICMP) for all surface ship classes. In 2000, services were improved via establishing and refining an ICMP customer service website; providing integrated readiness and assessment metrics; adding knowledge management features with an ICMP relational database management system; integrating ICMP and the Maintenance Requirements System to improve forecasting capability; integrating the ICMP application and database with the Navy data environment; and applying SURFMER logic to ICMP tasks.

Achieving Interoperability

Battle Force Interoperability

NAVSEA, as tasked by the Chief of Naval Operations, serves as lead agent for improving Battle Force Interoperability. As such, NAVSEA is accountable for developing policy and architectures for battle force warfare systems engineering, implementing a common warfare systems engineering process, providing top level direction for fielding and support of balanced combat systems for ships and submarines, baselining each Battle Group's warfare system capabilities, maintaining configuration control of baselines, verifying interoperability of Battle Group configurations, and certifying baseline configurations prior to deployment.

Force Readiness

The Battle Force Interoperability Certification Process ("D-30 Process") was implemented in August 1998 as the primary methodology for achieving certified battle force configurations, and

is one of the primary tools in NAVSEA's systems approach to resolving interoperability issues. This means each Battle Group is carefully tracked 20 months before deployment to ensure it is ready. The composition and equipment baselines for every active Carrier Battle Group, Carrier Air Wing, and Amphibious Readiness Group, including the Mine Warfare Readiness Group that begins deployment between 2000 and mid-2002, have been established and are being managed.

The *Management of Afloat Combat Systems and C4I Installations and Improvements* joint Commander-in-Chief instruction signed in April 2000 officially authorizes the D-30 Process for baselining battle forces to receive improved, certified, and interoperable warfighting technologies in preparation for deployment. The Battle Force Interoperability electronic Change Control Board, established under the auspices of this instruction, provides an electronic means for processing proposed hardware and software changes to ships with defined final baseline configurations. It enables a detailed risk assessment, and provides a means of review and approval of proposed changes online without the necessity of convening meetings. During the past year, over 700 changes covering 12 Battle Groups and initiated by program managers representing NAVSEA, the Naval Air Systems Command, the Space and Naval Warfare Systems Command, the U.S. Marine Corps, and the Fleet were evaluated. Although the normal time allocated for processing these changes is 23 days, short fuse requests were turned around in one day.

Battle Force Assessment

Within the Battle Force Assessment process there are two elements: platform certification and Battle Group certification. The platform level certification process is for combat system software. An integration test of the combat system is conducted to ensure that the computer programs are reliable, operable, and meet the functional requirements. Certification of non-Aegis platform ships is conducted through Combat System Integration Tests at NAVSEA's NWSC Port Hueneme Division/Detachment San Diego. During 2000, a number of combat systems and the following platforms were tested and analyzed: LHA 2/4, LHA 1/3/5, LHD 1, LHD 7, DD 963, FFG 7, LSD 41/49 and CV 67.

The Battle Group certification process characterizes the systems or programs that impact Battle Force Interoperability prior to authorizing platform delivery. This process uses the Distributed Engineering Plant (DEP), which nets together actual ship and aircraft hardware and software operating systems installed at stand-alone design and development software support activities, in-service engineering agencies, training and evaluation facilities, and training centers, to identify and resolve combat system and command, control, communications, computers, and intelligence interoperability problems at the Battle Group level.

During fiscal year 2000, six Battle Groups were tested and/or analyzed as part of the Battle Group Interoperability Test process performed by NAVSEA through the DEP Alliance consisting of engineering and test community activities from the systems commands: the USS *George Washington/Saipan* Battle Group, the USS *Lincoln/Tarawa* Battle Group, the USS *Truman/Bataan* Battle Group, the USS *Constellation/Boxer* Battle Group, the USS *Enterprise/Kearsarge* Battle Group, and the USS *Vinson/Peleliu* Battle Group. These tests were performed as part of the "D-30 Process" using actual deploying combat system hardware and software connected via the DEP. Test results provide updates as to the Battle Group's capabilities and limitations, and are delivered directly to the deploying Battle Group.

Capabilities and Limitations Documentation

In today's Battle Group, the Air Defense Commander embarked aboard a cruiser issues orders based upon a picture displayed by the ship's computers. Those orders are carried out 50 miles away aboard a destroyer whose Sailors interpret them in light of another picture drawn by different computers. NAVSEA's NSWC Port Hueneme Division's Battle Force Capabilities and Limitations (C&L) Manual explains how those pictures might differ, and how orders issued by one system are interpreted and displayed by the other system. The manual deals with the ability to form and share a single, coherent air picture from data gathered aboard many different units, and informs individual operators how their system affects the overall air picture and what to expect from other battle force units.

Available on classified network (SIPRNET) and CD-ROM, the C&L Manual is updated daily. During 2000, continuously updated documentation was provided to five deployed battle forces and seven pre-deployment battle forces. In addition, information was expanded to cover Joint exercises.

Cooperative Engagement Capability

Cooperative Engagement Capability (CEC) provides a revolutionary improvement in Battle Group air and missile defense capability. CEC is designed to optimize detection of incoming air threats and enhances the robustness, accuracy, and firepower of force-wide air and missile defense. Utilizing highly advanced data transfer and processing techniques, CEC is able to integrate the air defense sensors of surface ships, aircraft, and land sites into a single composite high-quality network.

During February 2000, the U.S. Navy successfully conducted integrated testing of CEC, the Aegis weapons system, the Advanced Combat Direction System, and the Command and Control Processor in the Virginia Capes operating area. A major objective of CEC Underway #8 was to provide a live, at-sea engineering assessment of the current operational evaluation versions of the systems and programs. Two combatant ships, USS *Hue City* (CG 66) and USS *Porter* (DDG 78), participated in this test, the eighth of eleven such tests.

In March 2000, a series of live testing events at Wallops Island, Virginia, demonstrated the successful integration of AN/SPQ-9B radar with CEC. The test period was the first of several that will involve CEC and the integration of sensor elements from the Ship Self Defense System (SSDS) MK 2, the next generation of self defense combat systems that will be

installed on aircraft carriers and large amphibious ships beginning in 2003.

In May 2000, CEC Underway #9 was held at the Atlantic Fleet Weapon Training Facility, Roosevelt Roads, Puerto Rico. It included live firing missile testing of Battle Group 6, and is part of a series of tests leading to CEC operational evaluation scheduled for spring 2001. Units included USS *John F. Kennedy* (CV 67) with its embarked CVW-20 airwing; the CEC-equipped Aegis cruisers, USS *Hue City* (CG 66) and USS *Vicksburg* (CG 69); USS *Mitscher* (DDG 57) and a CEC-equipped P-3D; and a prototype Hawkeye 2000 aircraft (E-2C).

The Navy took another step closer to fielding a system to provide one clear tactical picture that incorporates all available air-defense radars and sensors with CEC Underway # 10, which was completed in September off Wallops Island, Virginia. This test successfully verified specific critical technical measures in the areas of cooperative engagement, identification, composite tracking, data distribution, distributed air defense, system support , common tactical picture support, and force interoperability.

In July 2000, the first CEC and Theater Ballistic Missile Defense capable ship, USS *McCampbell* (DDG 85), was christened. *McCampbell* is the 35th of 58 *Arleigh Burke* (DDG 51) Class destroyers.

Distance Support

NAVSEA continues to advance the Navy's use of information technology and e-business techniques. Offering solutions to the Fleet, the Distance Support coalition continues to build the Fleet's information super highway and provide greater assistance from shore-based facilities. Begun in August 1998, NAVSEA and its Naval Sea Logistics Center continued their teaming efforts with the Naval Supply Command in 2000, and expanded their alliance to include the Space and Naval Warfare Systems Command, the Naval Air Systems Command, the Chief of Naval Education and Training, the Chaplain Corps, the Bureau of Medicine and Surgery, the Naval Ammunition Logistics Command, and the Fleet.

Distance Support offers Fleet Sailors a single point of entry into a corporate-wide network for supply and technical support assistance using a toll-free number, a website, and e-mail connectivity. Sailors can call 1-877-4-1-TOUCH to reach the Navy Integrated Call Center, which is open 24 hours a day, 7 days a week and 365 days a year. They can also visit the website at http://www.fleetsupport.navy.mil .

Addressing bandwidth concerns and technical limitations, the Logistics Center designed and developed the electronic communication paths to the Anchor Desk and the Distance Support Portal (a CD-ROM version of the website for efficiency). Several collaboration tools are also accessible, including NetMeeting and Sametime Chat, applications which facilitate intra-ship, ship-to-shore, and ship-to-ship communication.

Distance Support is planned for every Battle Group. The first Fleet installation, in August 2000, was in the USS *Abraham Lincoln* Battle Group, which used this important maintenance and support tool nearly 2,000 times during its deployment. The USS *Constellation* Battle Group will be next. Distance Support is both a revolutionary and evolutionary support effort to the Fleet. New technology and techniques will be introduced to increase shore support of deployed assets.

NAVSEA's NSWC Crane regularly supports Distance Support efforts for the Fleet.

Navy Ships Material Condition Metrics Website

In October 2000, NAVSEA officially established the Navy Ships Material Condition Metrics web-based application. This website (http://www.maintenance.navy.mil) provides military, civilian, and contractor support personnel the capability of a dynamic, single-point access to multiple information sources including Fleet performance and assessment data and indicators, summary data trends, and equipment condition assessment data. Users have the ability to "slice and dice" data as well as view charts and graphics summarizing the results, all without leaving the website interface. In addition, links are provided to related ship maintenance resource websites.

Distance Learning for Electrolytic Oxygen Generator

NAVSEA's submarine training system program is developing prototype web-enabled, browser-based courseware for use in conjunction with the electrolytic oxygen generator front panel simulator to allow Sailors to study the oxygen generator operator maintenance course "on board" prior to attending the formal course of instruction. A Sailor need only be at the training facility to practice and demonstrate the ability to perform the skills required to an instructor. As advances in technology occur and use of the internet for distributed learning continues to evolve, NAVSEA will evaluate additional topics for possible incorporation into the training program.

Common Problem Reporting System

The Common Problem Reporting System (CPRS) is a consolidated Fleet reporting system that provides the capability to report all Non-Propulsion Electronics System problems back to a web-based database. Prior to CPRS, submarines and other users completed paper forms required by multiple Fleet reporting processes

to report and describe engineering problems. NAVSEA assembled a CPRS design team to formulate recommendations for improving and consolidating the existing problem reporting processes.

The CPRS design incorporates a wide-scale application of a commercially available database management system to replace all existing data systems and to achieve commonality of data management. Existing data/table structures, data elements definition, and reporting requirements from these databases have been, and continue to be, carefully analyzed to ensure that common areas are properly consolidated and any unique requirements are ultimately addressed by CPRS. It has reduced the number of problem reporting systems by over 90 percent and has reduced the staffing resources to operate and service them by over 80 percent.

Fully operational, CPRS provides access via the Internet 24 hours per day, 7 days per week, to authorized users, and provides them with the ability to enter new problems, search for problem status, submit updates, and generate reports.

Salvage and Diving

On September 12th, USS *La Moure County* (LST 1194) ran aground off the coast of Chile while conducting joint U.S. Marine Corps amphibious assault exercises. The ship sustained major structural damage from the bow to approximately midships, and flooded over 30 tanks and spaces. NAVSEA responded to this Fleet emergency by mobilizing its Salvage and Ocean Engineering Division, including technical personnel, an oil pollution specialist, salvage equipment from the Emergency Ship Salvage Material (ESSM) warehouse, and its ESSM and underwater ships husbandry welding contractors.

Dive station set up on dive barge.

Diver prepares the ship's hull for beam installation.

Working with NAVSEA engineers and Mobile Diving Salvage Unit Two (MDSU-2) personnel, a salvage plan incorporating buoyancy recovery, hull girder strengthening, and pollution control was jointly developed and implemented. MDSU-2 divers, NAVSEA salvage engineers, and the ESSM contractor patched and dewatered tanks deemed critical for watertight restoration. The remaining damaged fuel tanks were stripped of all accessible fuel to minimize the possibility of further pollution contamination. Concurrent with the flooding and pollution abatement efforts, NAVSEA's underwater welding contractor installed three box girders beneath the hull to replace critical overall hull girder strength. The operation culminated in MDSU-2 and NAVSEA's towing specialist preparing and successfully towing *La Moure County* to Talcahuano, Chile, for further disposition.

Ship Inactivation and Disposal

Modernizing America's Navy requires ship inactivations and disposal, which play a crucial role. NAVSEA's Inactive Ships Program supports the Fleet by assuming the bulk of ship inactivation work from the ship's crew, which allows Sailors to return to the Fleet sooner. This improves the quality of life for Sailors assigned to a decommissioning ship, and provides direct logistics support with recycled shipboard materials, significantly reducing Fleet operating costs.

In 2000, the program also successfully donated several obsolete shipboard materials to be used as memorials throughout the country. In addition, the battleship *New Jersey* was donated to the Home Port Alliance, in Camden, New Jersey, and the battleship *Wisconsin* was prepared for display at Nauticus, in Norfolk, Virginia.

NAVSEA also continues to inactivate nuclear-powered submarines and cruisers in accordance with established decommissioning schedules. Reactor compartment disposal and hull recycling is conducted at Puget Sound Naval Shipyard. In fiscal year 2000, nine submarines completed inactivation; four of the nine also completed reactor compartment disposal and hull recycling. One nuclear powered cruiser (CGN) completed the first combined CGN inactivation/reactor compartment encapsulation and disposal/hull recycling availability. One previously inactivated CGN also completed a combined reactor compartment encapsulation and disposal/hull recycling. Additionally, the decontamination of one previously inactivated AD tender was completed.

Naval Sea Systems Command

Building for Tomorrow

In the Persian Gulf, aircraft from Carrier Wing Seven during a formation fly-by of USS John C. Stennis *(CVN74).*

NAVSEA

NAVAL SEA SYSTEMS COMMAND

Keeping America's Navy #1 in the World

Current readiness is extremely important as the previous section underscores. However, "building for tomorrow" is necessary for ensuring future readiness and Keeping America's Navy #1 in the World.

Ships

Aegis Shipbuilding

NAVSEA's Aegis shipbuilding division successfully delivered three *Arleigh Burke* (DDG 51) Class destroyers to the Fleet in 2000—USS *Oscar Austin* (DDG 79), USS *Roosevelt* (DDG 80), and USS *Winston S. Churchill* (DDG 81). Thirty-one *Arleigh Burke* Class ships have been delivered to the Fleet to date, 20 are under contract, and an additional six are planned to be awarded in 2001.

Oscar Austin, Roosevelt, and *Churchill* are the first three Flight IIA ships. Flight IIA destroyers are equipped with the Navy's Aegis combat system, the world's foremost naval weapon system. Space age communications, radar, and weapons technology are combined in a single warship for unlimited flexibility. These systems include the AN/SPY-1D phased array radar; the MK 41 vertical launching systems to fire a combination of surface-to-air and TOMAHAWK surface-to-surface missiles; and the AN/SQQ-89(V)10 antisubmarine warfare system. Additional warfighting capabilities include MK 32 Mod 7 torpedo tubes; MK 15 Phalanx close-in weapons systems; and a multimission 5-inch deck-mounted gun, which can be used as an antiship weapon, a close-in point defense, or in support of forces ashore with naval gunfire support. In addition, they introduce helicopter handling and support facilities with hangar bays for two SH-60B helicopters.

During *Churchill's* Builder Sea Trials, the Extended Range Guided Munitions and the new 5-inch/62 gun mount successfully completed structural test firings. Future ships in Flight IIA will incorporate Area Theater Ballistic Missile Defense, Cooperative Engagement Capability, AN-SPY 1D(V), Evolved SEASPARROW Missile, and remote minehunting systems.

The year 2000 saw great advancement in the Electronic Trial Card (ETC) initiative. ETC was successfully used for the first time at SUPSHIP Pascagoula for the *Roosevelt's* Builder Sea Trials in February and March. It was used again by SUPSHIP Pascagoula at USS *Lassen's* (DDG 82) Builder Sea Trials in November and December. Phase III of ETC, which allows inspectors to close out trial cards, was successfully put into production at SUPSHIP Bath in late September.

Aircraft Carriers

Aircraft carriers have long been the center of Naval global forward presence, deterrence, crisis response, and warfighting. Their contributions to American diplomacy in peacetime and their ability to perform a range of missions make them invaluable to

USS Abraham Lincoln *and F-A-18 Hornets from its airwing*

our current and future force structure inventory. PEO Aircraft Carriers are responsible for acquisition and life-cycle support planning.

***Ronald Reagan* (CVN 76)** is currently under construction at Newport News Shipbuilding; the keel for CVN 76 was laid in February 1998, was christened March 4, 2001, and will be commissioned in early 2003. *Reagan* will replace the conventional carrier USS *Constellation* (CV 64) which will be 41 years old at that time. At the end of 2000, major structural fabrication was approximately 98 percent completed; the island was landed on CVN 76 on November 11.

CVN 77, authorized in 1998 and contracted for in December 2000, continued with extensive planning and preparations for ship construction at Newport News Shipbuilding under its advanced procurement contract. The tenth and last ship of the *Nimitz* (CVN 68) Class, CVN 77 will enter service in 2008, replacing USS *Kitty Hawk* (CV 63) and serving as a transition ship for the next generation of aircraft carriers, CVNX.

Concept drawing of CVN 77.

Year 2000 efforts included such major activities as development of the CVN 77 Contract Design Package, development of a new Integrated Warfare System concept, selection of the warfare systems integrator from competing industry teams, procurement of long lead components and material, continuation of advanced hull module fabrication, and the planning and engineering efforts needed to support these activities. In addition to a fully integrated 21st century warfare system being designed by the Lockheed Martin Corporation industry team, CVN 77 will incorporate nearly 360 carefully selected design improvements, which will enhance functionality and safety with substantial operating cost reductions. Every major planning milestone for 2000 was completed on or ahead of schedule.

LCAC Acquisition/Life Cycle Management Program

The Landing Craft, Air Cushion (LCAC) is a high-speed, over-the-beach, fully amphibious landing craft capable of carrying a 60-ton payload and designed to lift equipment organic to the Marine air-ground task force in amphibious operations. It is the cornerstone of the U.S. amphibious modernization program, and a revolutionary means for the Navy/Marine Corps to project power or assistance over more than 70 percent of the world's shoreline. Developed, manufactured, and supported by Textron Marine & Land Systems, the LCAC is in worldwide use by the Navy.

Capable of 40-knot speeds in Sea State Two, the LCAC can traverse snow, marsh, ice, tundra, sand, and water carrying up to 150,000 pounds (68,040 kg) of cargo in overload mode. Beyond its basic mission of transporting personnel and equipment from ship to shore, the LCAC has become a multimission craft. For example, when outfitted with a modular sweep deck, it is an effective minehunter/sweeper. As a troop carrier, the LCAC can be outfitted with a reconfigurable Personnel Transport Module that carries up to 180 people. In civil emergency, the LCAC's 75-ton cargo capacity enables the craft to deliver lifesaving supplies and equipment to otherwise inaccessible sites. And as a Medivac "transport," the LCAC's speed ensures rapid response and timely extraction.

The first LCACs were delivered in 1984 with a service life design of 20 years. To date, a total of 91 LCACs have been delivered. All craft have performed at or above expectations and have become an integral part of the Navy's amphibious capabilities.

The LCAC will enter the 21st Century with markedly

Landing Craft Air Cushion (LCAC) with a full combat load.

improved performance and an increased life span due to the Service Life Extension Program (SLEP). LCAC 91, which was delivered to the Navy in December 2000, incorporates numerous equipment and system upgrades that will be part of the planned SLEP improvements. Through SLEP, the LCAC continues to define state-of-the-art with an expanded performance envelope, reduced operating costs and crew workload, longer service life, and improvements in combat readiness.

LHD Program

Amphibious assault ships (LHDs) embark and debark various units of Marine Corps assault forces, including aviation assets, and all of their required vehicles and equipment in "From the Sea" operations.

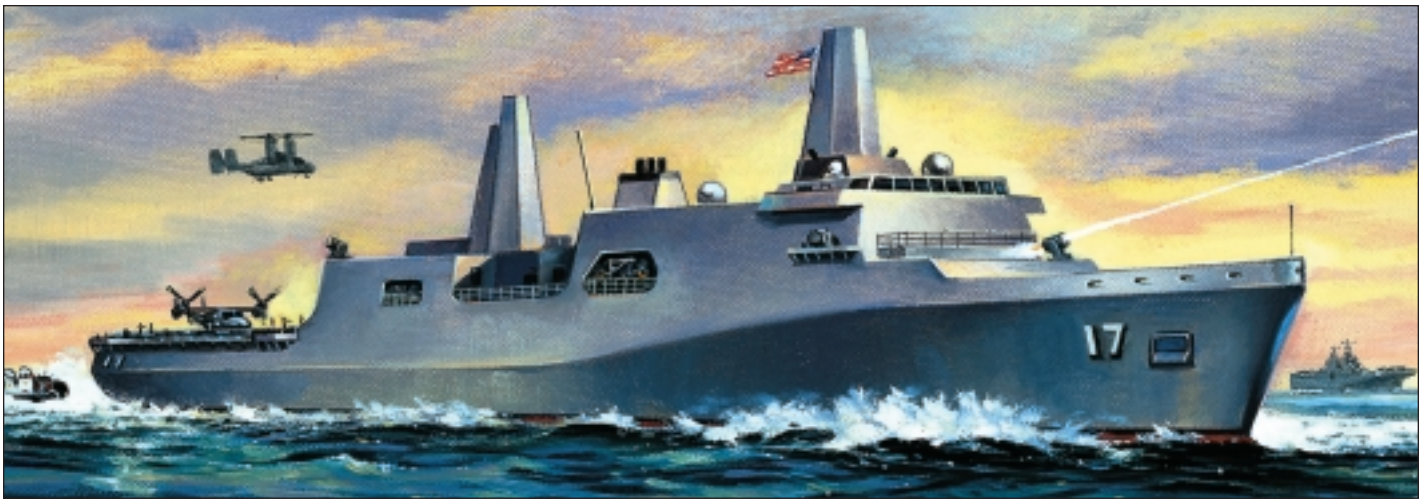
Iwo Jima (LHD 7), the Navy's last amphibious ship with conventional steam propulsion, was launched in February 2000 and christened in March. Her Number 2 and Number 1 boilers were lit off for the first time in August and September, respectively. Testing of the ship's equipment and systems began and culminated with *Iwo Jima* completing Builder Trials in December 2000. *Iwo Jima* has numerous modifications and improvements incorporated into her design, including a fuel compensating system and a Sigma Edgeguard coating system.

The LHD 8 Detail Design Contract was awarded to Ingall's Shipbuilding, Inc. in July 2000. This ship will be the first of its class constructed with gas turbines and all-electric auxiliary systems. Additional improvements and modifications include reverse osmosis desalination, electric loiter motors, and wireless communications. Construction is planned to begin in December 2002, with delivery scheduled for June 2006.

LPD 17 Program

In 2000, the LPD 17 program, managed by PEO Expeditionary Warfare (PMS 317), began transitioning from detail design to lead ship production. Supported by SUPSHIP New Orleans, construction of *San Antonio* (LPD 17) began in

Sea Shadow (IX-529) berthed astern of the USS *Hornet* museum ship at Alameda, California. The Navy test and research craft, designed and built in the 1980s, acts as a test platform for emerging surface ship technologies, including maritime stealth, ship control, and automation for reduced manning. *Sea Shadow* operates with a crew of eight and is capable of sustained endurance in open ocean sea states due to its unique SWATH hull form which minimizes ship motions. A large, reconfigurable payload space can accommodate various equipment and personnel for specific testing purposes. Since its reactivation in 1999, *Sea Shadow* has participated in various Fleet exercises and experiments, and has supported proprietary industry-based research testing.



Artist's conception of San Antonio *(LPD 17)*

August, followed by the keel laying ceremony in December. The first two ships of the class, *San Antonio* (LPD 17) and *New Orleans* (LPD 18), are being built at the Litton-Avondale shipyard in New Orleans, Louisiana. LPD 19 was awarded in February 2000 and will be constructed at Bath Iron Works, Bath, Maine; LPD 20 (*Green Bay*) was awarded in May 2000 and will be built at Litton-Avondale. Preparations for sustained production in the two shipyards in 2001 are proceeding with increased NAVSEA representation at Bath Iron Works.

The 12-ship LPD 17 Class is being designed for its Navy and Marine Corps customers in an Integrated Product Data 3-D Environment utilizing three-dimensional computer models. Simulation software has been used to create a virtual crew environment, allowing for early Fleet input, and identification and resolution of design issues in a cost-effective manner before the ship is constructed. The virtual crew concept allows Sailors and Marine Corps subject matter experts from the amphibious force to interact directly with ship designers and 3-D computer models. To date, over 350 ship spaces have been examined by 625 Sailors and Marines during over 76 video teleconference sessions. This concept of providing significant improvements in warfare and operational capability, reduced workload, and improvements in quality of life has contributed to an unprecedented level of design maturity prior to ship construction.

Seawolf Class Submarine

In November 2000, USS *Connecticut* (SSN 22), the second of three *Seawolf* Class submarines, completed her post shakedown maintenance availability. Delivery of the first two submarines provides the Fleet with the two quietest, most heavily armored and most sophisticated combat warships in the world today. PEO Submarines is responsible for acquisition and life cycle support planning.

The third *Seawolf* Class submarine, the PCU *Jimmy Carter* (SSN 23), will lead the Navy's efforts to explore technology demonstrations and multimission capabilities. By advancing state-of-the-art submarine design and operational practices, the *Jimmy Carter* will support classified research, development, test, and evaluation efforts for notional Naval special warfare missions, tactical undersea surveillance, and undersea warfare concepts. These modifications, which will include adding 100 feet of ship length to support these new multimission opportunities, have rescheduled delivery until mid-2004.

The *Seawolf* Class submarine program continues to identify innovative modernization and commonality initiatives to provide affordable life-long service and reduce total ownership cost of *Seawolf* Class submarines. These initiatives include the use of *Virginia* (SSN 774) Class systems such as propulsors and radio room, investing in common combat systems architecture via the BSY-2 Advanced Rapid COTS (commercial-off-the-shelf) Insertion and the BLQ-10 programs, and restructuring of *Seawolf* Class support from the Navy supply community.

Virginia Class Submarine

In December 2000, the Secretary of the Navy named the fourth submarine of the *Virginia* Class, *North Carolina* (SSN 777). The third submarine of the *Virginia* Class, *Hawaii* (SSN 776), was authorized in 2000. The *Virginia* Class is the next generation attack submarine that offers multimission capabilities optimized for littoral operations while maintaining deep-water superiority. *Virginia's* requirements are stealth equal to the *Seawolf* (SSN 21) Class, flexibility to adapt to future needs, and affordability. Thirty *Virginia* Class submarines are in the program plan.

Several "firsts" characterize the *Virginia* Class design: It is the first submarine program to implement entirely electronic design, decreasing reliance on drafting boards and paper drawings. It is the first to be

Virginia *Class submarine.*

designed "from the keel up" to support Special Operations Forces(SOF)/SEALs. It is uniquely designed with built-in flexibility for future insertion of advanced technology in a cost-effective way, which allows the Navy to constantly adapt the ship to emerging threats and requirements. And, its modules will allow reconfiguring a hull during new construction. It is envisioned that later ships of the class will be capable of interchanging a payload or sensor module to tailor capabilities to a threat tasking.

Fully ready to serve as a host platform for Dry Deck Shelters and the Advanced Seal Delivery System, the *Virginia* Class will also contain an organic Lock-Out Trunk (LOT) through which nine SOF team members can deploy with their equipment. This LOT capability is also being looked at for 22-man mass escape using the newly introduced Submarine Escape and Immersion Equipment escape appliance from shallower depths.

During 2000, the first increment of the pre-commissioning crew reported to *Virginia*. When fully manned, the crew size will be 14 officers and 120 enlisted men.

SSBN-to-SSGN Conversion

The *Ohio* (SSBN 726) Class SSBN-to-SSGN Conversion Project develops modifications to four Trident submarines no longer required for strategic deterrence roles. These modifications will provide a robust conventional strike capability using TOMAHAWK Block III and Tactical TOMAHAWK missiles, as well as the capability to deploy Special Operations Forces (SOF) using integral lock out chambers, Dry Deck Shelters, or the Advanced SEAL Delivery System. Current plans call for a maximum weapons load of 154 cruise missiles and additional berthing for an on-board contingent of 66 SOF personnel. The conversion of Trident SSBNs to a strike/SOF role will provide significant capability at a cost considerably below the procurement cost of new platforms. This innovative modification leverages prior shipbuilding investments, efficiently providing a multimission platform with unequalled weapons load and Special Operations capability.

During 2000 a structure of Integrated Product Teams was established, and a baseline conversion configuration was developed and documented. The teams developed an integrated program schedule, and began work on documentation required for formal establishment of an acquisition program. Over 30 trade studies to refine the system concept were conducted.

Cruiser Conversion Program

In order to preserve the relevance of Aegis cruisers into the 21st century, the Cruiser Conversion Program was established to introduce new critical missions and joint warfighting capabilities into the Aegis Guided Missile Cruisers (i.e., *Ticonderoga*—CG 47—Class). Aegis cruisers were initially modernized through "block upgrades" during new construction. Cruiser conversion will employ a similar strategy to introduce new mission capabilities to 22 of the 27 ships (Baseline 2, 3, and 4 ships). Conversion of these ships is a cost-effective investment to support force level goals, introduce new and critical warfighting capabilities, extend the service life, and reduce operating and maintenance cost. The program will deliver operationally ready Aegis cruisers capable of performing Area Theater Ballistic Missile Defense, Area Air Defense Commander, and land attack missions beginning in 2004 in support of U.S. national security.

Strategic Sealift Program

During calendar year 2000, the Strategic Sealift Program continued its aggressive Fleet introduction of large, medium-speed, roll-on/roll-off (LMSR) ships with delivery of four new construction ships: USNS *Seay* (T-AKR 302), built by Litton Avondale Industries, and USNS *Red Cloud* (T-AKR 313), USNS *Charlton* (T-AKR 314) and USNS *Watkins* (T-AKR 315) built by National Steel and Shipbuilding Company and supervised by NAVSEA's SUPSHIP San Diego. Additionally, three LMSR ships were christened and launched, and the final LMSR new construction ship, T-AKR 317, began construction. To date, 14 of 19 planned LMSRs have been delivered. The 19 ships will provide a combined total of more than 5 million square feet of additional capacity for the afloat prepositioning and surge sealift of military vehicles and supplies. Six LMSRs are deployed, and allow the Navy to deliver Army helicopters, tanks, and other military vehicles to support warfighting operations worldwide.

USNS Pililaau *(T-AKR 304) christening.*

Systems-Ordnance

Naval Surface Fire Support

The mission of the Naval Surface Fire Support (NSFS) program is to design, build, and field responsive, lethal, and affordable combat systems that will meet operational requirements. The need to improve NSFS has become increasingly important since the end of the Cold War and the subsequent decommissioning of the Navy's battleships. NSFS capabilities are critical to a ground force's ability to destroy targets of interest and to maneuver without having to carry large amounts of artillery. Key developmental systems managed by the NSFS Program include the Mk 45 Mod 4 5-inch/62 Caliber Gun Mount, the EX-171 5-inch Extended Range Guided Munition (ERGM), the Naval Fires Control System, and the Land Attack Missile Fire Control System.

The Navy conducted a successful Structural Test Firing of the Mk 45 Mod 4 gun in July 2000 aboard the USS *Winston S. Churchill* (DDG 81). The purpose of the test was to evaluate the structural response of *Churchill* to the gun while shooting both conventional and ERGM ammunition. This was the first time the newly modified gun had been fired at sea.

In August 2000, ERGM completed a successful dynamic dispense test of the munition's payload section. The test, conducted by Raytheon Missile Systems and Primex Aerospace Company in Yuma Proving Grounds, Yuma, Arizona, was designed to demonstrate the engineering concept for the payload dispense mechanism and the resulting submunition dispense pattern.

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USS Winston Churchill *successfully test fires the new Mk 45 Mod 4 5-inch gun mount.*

Ship Self Defense System

The Ship Self Defense System (SSDS) is an evolutionary acquisition of improved ship self defense capabilities for selected ships against anti-ship cruise missiles (ASCM). It integrates several existing stand-alone sensor and anti-air warfare weapons systems that do not individually provide the complete detection, control, and engagement capabilities needed against low flying, high speed ASCMs with low radar cross sections. The SSDS integration concept fulfills the need for an automated detection, quick reaction, and multi-target engagement capability emphasizing performance in the littoral environment. System design emphasizes physically distributed non-developmental items, commercial standards, and computer program reuse in an open architecture computer network.

Fleet deployment in the *Whidbey Island* (LSD 41)/*Harper Ferry* (LSD 49) Classes continued during 2000, with three installations successfully completed. Also completed in 2000 was the installation of SSDS at the Fleet Combat Training Center Atlantic, Dam Neck, Virginia. Two ship sets of SSDS equipment were placed under contract in 2000 to support 2001 installations. A follow on program, called SSDS Mk 2, is planned for installation on LPD 17.

Vertical Launching System

The MK-41 Vertical Launching System (VLS) significantly improves missile capacity, flexibility, multimission capability, reaction time, and rate of fire, and is designed to be adaptable to present and future weapon systems. The primary components of VLS are the launcher structure, launch control computer equipment, and missile canisters. Canisters are used as the storage/shipping container for missiles ashore and as the magazine/firing tube aboard ship.

MK-41 VLS is the premier launching system for modern surface combatants including 22 *Ticonderoga* (CG 47) Class cruisers, 30 *Arleigh Burke* (DDG 51) Class destroyers, 24 *Spruance* (DD 963) Class destroyers, and 11 ship classes of nine Allied navies. The MK-41 VLS is currently capable of launching STANDARD missiles, NATO SEASPARROW missiles, Vertical Launch ASROC (VLA), and TOMAHAWK cruise missiles. The integration of new missile variants with the launcher is an active part of the program.

Five new missile integration projects are underway: STANDARD Missile-2 (SM-2) Block IVA, SM-3, Tactical TOMAHAWK, Evolved SEASPARROW Missile (ESSM), and VLA-Lightweight Hybrid Torpedo. Three programs—SM-2 Block IVA, SM-3, and ESSM—have completed several flight combined tests. Launcher and missile canister modifications to accommodate new missiles, and replacement of obsolete equipment have been the primary engineering priorities. In addition, launch control units are evolving from outdated and unavailable equipment to commercial-off-the-shelf technology in cabinets requiring less space.

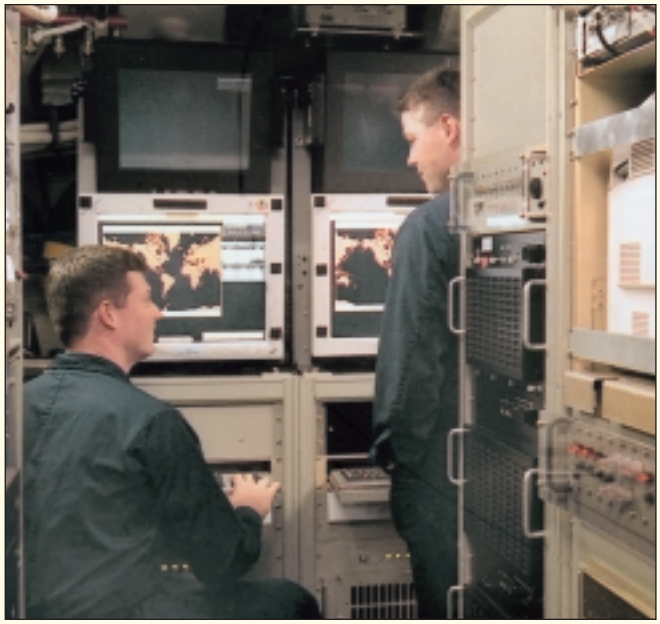
Submarine Modernization

Modernizing America's submarine force is a key task for NAVSEA. This requires ensuring the commonality of hardware, software, and human-machine interface across the entire

Submarine Force. The capabilities of the submarine warfare system include individual sensors, controls, and weapons subsystems aboard the submarine.

In 2000, planning for warfare systems modernization began. The successful Advanced Processing Build process used by the acoustics Advanced Rapid COTS (commercial-off-the-shelf) Insertion now applies to all future technology insertion for the submarine warfare system. A tactical working group was established in February 2000 to act as the focal point for Fleet inputs into new tactical software functionality and human-machine interfaces.

The first tactical Advanced Processor Build was also defined. This system upgrade focuses on improving the ability to tactically control the ship during a close encounter scenario. It features advanced algorithms; automated target motion analysis and solution development; and simplified, highly intuitive displays that will bring all the information needed directly to a dual-paneled workstation. This is the first major step toward separation of weapon control and tactical control and information management.



The **AN/BLQ-10(V)**, shown here on USS *Annapolis* (SSN 760), will provide the submarine force with an electronic warfare support system based on a modern, modular, open architecture. This allows technology refresh or technology insertion of new capabilities through the addition of new modules or replacement of existing modules.

Disabled Submarine Rescue Protocol

As part of the team helping to develop the next generation submarine rescue equipment and procedures, NAVSEA's Navy Experimental Diving Unit (NEDU) has been instrumental in identifying, testing, and evaluating a variety of equipment and procedures to enhance the safety of our submariners in the event an at-sea submarine rescue operation is required. One such initiative is the Disabled Submarine Rescue Protocol.

Responding to an urgent need for improved disabled submarine rescue decompression procedures for Deep Submergence Rescue Vehicle (DSRV) operations, NEDU performed an extensive series of human trials to determine the feasibility of utilizing 100 percent oxygen to reduce decompression requirements. Even though initial trials resulted in an unexpectedly high incidence of severe decompression sickness, NEDU persisted and successfully developed an acceptable strategy which incorporates oxygen breathing prior to decompression. These critical findings have been rapidly implemented into Fleet use, and DSRV *Mystic* is undergoing modification to allow oxygen breathing.

AN/SQQ-32(V)3 Sonar

Fiscal year 2000 signified the first year of a near-term, low-cost project to evaluate, develop, test, and field improvements to the AN/SQQ-32(V)3 mine hunting sonar. NAVSEA, the Applied Research Laboratory/University of Texas, and Raytheon are teaming together to develop changes to the system that address some of the Fleet's current challenges especially the littorals, including low target strength mines, shallow water environment, and operator effectiveness.

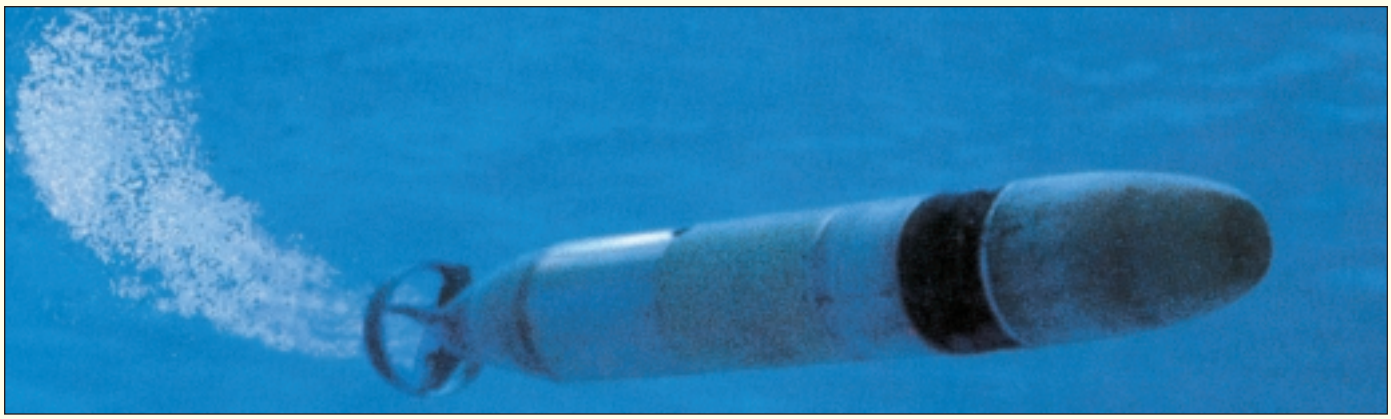
A longer transmit pulse length and alternate signal processing routine, Detection Replica Correlator (DRC), was developed and tested in July 2000 and is slated for fielding in fiscal year 2001. DRC demonstrated potential to reduce screen clutter without negatively impacting detection capabilities. During July and August 2000, the first phase of a sensor baseline test was conducted in shallow water at Panama City, Florida, to quantify the AN/SQQ-32 performance capabilities against the littoral threat and environment. The sensor baseline test and analysis will establish a baseline foundation for ensuring any improvements to existing sonar or the development of a new sonar, and will provide a measurable increase in the surface Fleet's minehunting capabilities.

Also in 2000, NAVSEA continued the post-installation training for the introduction of the AN/SQQ-32(V)3 system. Three ships—USS *Champion* (MCM 4), USS *Devastator* (MCM 6), and USS *Scout* (MCM 8)—conducted extensive mine recognition, mine-hunting, and system degradation recovery training at NSWC Panama City, Florida. The training provided the opportunity to hunt 12 different mine threats and multiple non-mine objects.

Mark 66 Mod 4 2.75-Inch Rocket Motor

NAVSEA has been involved in the design and manufacture of the 2.75-inch rocket system since its inception in the early 1950s. The 2.75-inch rocket system is the most widely used air-to-ground rocket system in the world, with the U.S. military using over 250,000 2.75-inch rockets in fixed wing airplane and helicopter gunnery training a year. Recent requirements have been to develop new technology to protect ordnance from unplanned ignition by electromagnetic energy in the environment.

In the early 1990s, NAVSEA began developing a new 2.75-inch rocket motor that would meet the requirements of the hazards of electromagnetic radiation to ordnance (HERO) standards. In 1996 NSWC Indian Head designed, qualified, and received approval for the naval deployment of the "HERO-Safe" Mk 66 Mod 4 2.75-inch rocket motor. Recent success has also



The **MK 39 Expendable Mobile ASW Training Target (EMATT)** is a small, lightweight, low cost, self-propelled underwater vehicle that may be launched from fixed wing and rotary wing antisubmarine warfare (ASW) aircraft and ASW surface ships. The MK 39 Mod 1 was introduced to the Fleet just before the start of fiscal year 2000. It includes significant performance and design enhancements over the Mod 0, including an integrated tracking pinger for use on test ranges, torpedo compatibility for all current U.S. torpedoes, autonomous evasion maneuvers, variable tonal levels, and improved active acoustic response. The Fleet has provided strong positive feedback regarding the Mod 1. A new variable speed version, Mod 1A, is presently under evaluation, and is focused towards providing increased realism by offering multiple speeds, increased endurance, and external remote programming.

been achieved with the introduction of this rocket motor into all the inventories of all the U.S. military services.

AN/SLY-2(V) Advanced Integrated Electronic Warfare System

The AN/SLY-2(V) Advanced Integrated Electronic Warfare System (AIEWS) is the next generation of shipboard electronic warfare systems. Scheduled to replace the current AN/SLQ-32(V) system starting in fiscal year 2003, it is an integrated, revolutionary ship self defense system that will become an essential combat system element. The AIEWS will be backfit in CG 52-73, DDG 51-90, LPD 17-21, CVNs, LSD 41/49, and LHD ship classes. It will be forward fit in DDG 91 and above, LPD 22, CVN 77, and possibly DD 21 ship classes, as well as in land-based test and training sites.

AIEWS will be integrated with the Ship Self Defense System (SSDS) as well as with the Aegis combat system to support the Department of Defense's Joint Vision 2010 concept of full dimensional protection. It will incorporate an open architecture that will allow modern technology insertion and facilitate use of commercial-off-the-shelf and non-developmental items. The system is designed for layered and coordinated countermeasures in the littoral operational environment, with special emphasis on the full integration of all soft-kill elements into the ship's anti-air warfare systems. AIEWS's incorporation into a ship's layered defense system is essential for ship survivability under the intense conditions in the littoral as well as open ocean environments.

During 2000, the systems acquisition of the AIEWS program, including engineering and manufacturing development, continued. The AIEWS Critical Design Review was successfully completed in early 2000. Additionally, a Critical Performance Demonstration in an at-sea environment was successfully conducted aboard USS *Philippine Sea* (CG 58).

Integrated Maritime Portable Acoustic Scoring and Simulator

The Integrated Maritime Portable Acoustic Scoring and Simulator (IMPASS) is a new, low-cost, portable, waterborne, acoustic, impact scoring system and simulator which will expand the currently limited firing range capability to any environmentally suitable open-ocean area. Conceived in 1998, this innovative approach will enable Navy ships to conduct cost-effective live fire exercises and supplementary training at sea in order to qualify and improve their preparation for forward area deployment. In addition, it will provide related proficiency training during routine operations in theater. As a result of NAVSEA's NSWC Indian Head Division's research and deliberations with Fleet representatives, a means of providing live Naval gun fire support training at sea was conceived and designed. Subsequently, key prototype components were obtained and field-tested sufficiently to validate the essential technical concept. This rapid prototyping effort has set the stage for full development of an exercise scoring system that is lightweight, compact, and easily stored aboard ship, and one that can be employed at suitable locations throughout the world's oceans.

Laser Tracker System Calibration Standard

The Naval Warfare Assessment Station (NAVSEA Corona) has teamed with the National Institute of Standards and Technology to develop a new calibration standard for laser tracker systems via a three-year project. The laser tracker is a laser-based spherical coordinate measuring machine used for large-scale measurements.

Although laser tracker systems have been in use for several years in the aircraft, shipbuilding, and manufacturing industries, there is no national standard in existence to compare the various laser systems currently in use. NAVSEA saw a need for a calibration standard to quantify the uncertainty in these measurements and to evaluate the accuracy of these systems. The calibration standard will consist of a set of physical artifacts used to conduct numerous measurements which will be analyzed by an uncertainty verification software program. The calibration standard will also be implemented into the American Society of Mechanical Engineers national performance standard.

Acoustic Rapid COTS Insertion Sonar System (AN/BQQ-10)

The Acoustic Rapid Commercial-Off-the-Shelf (COTS) Insertion (ARCI) Sonar System continued an aggressive development, test, and delivery schedule in 2000. NUWC Newport developed and delivered ARCI Phase II+, an early integration of the towed array Advanced Processing Build (APB99), to USS *Memphis* (SSN 691) in April. Development sea tests were conducted in April and May, and a certified build was delivered to the ship in June.

ARCI Phase III/IV fully integrates the sphere, hull, towed, and high frequency arrays into the ARCI Sonar system. Initial installations were completed on USS *Scranton* (SSN 756) and USS *Asheville* (SSN 758). A multiple phase at-sea technical evaluation was conducted during the September-November 2000 time period. Operational evaluation is scheduled in early 2001.

Progress toward sonar commonality continues. The *Virginia* Class (SSN 774) sonar variant was delivered in December 2000. The ARCI variant for the BSY-2 sonar subsystem has started development. The Advanced Processing Build process will continue to deliver yearly processing upgrades in response to Fleet requirements. These upgrades are possible because of the COTS architecture upon which ARCI is based. A single ARCI Phase II system has more processing power than the combined legacy sonar systems of the entire SSN/SSBN submarine force.

Conformal Acoustic Velocity Sonar

The Conformal Acoustic Velocity Sonar (CAVES) project is developing a cost-effective "smart-skin" acoustic receive array for submarines that represents a revolutionary departure from

The **PHALANX Close-In Weapon System** is a fast reaction, rapid fire, computer controlled, radar guided 20mm gun system primarily designed to engage anti-ship missiles. PHALANX provides autonomous or integrated search, detection, declaration (threat evaluation), acquisition, track, firing, target destruction, automatic kill assessment, and cease-fire. Without assistance from other ship systems, it will automatically engage anti-ship missiles that penetrate a ship's primary defense systems. By the end of 2000, PHALANX was installed in 191 U.S. platforms (355 weapon systems) and deployed with 21 foreign countries.

traditional hull array sonar technology. Developed by NAVSEA's NUWC Newport for PEO Submarines (PMS 425), CAVES will replace existing pressure sensor technology (which requires tons of expensive outboard signal conditioning and support structures) with an array of accelerometers that will be integral to hull coating. An eventual benefit will be to provide a much more capable, passive, acoustic receiver that can exploit low frequency signals. Ultimately, CAVES represents an affordable and scaleable array technology for use in multiple applications.

CAVES develops and demonstrates scalable, affordable, low-ship impact hull array technology. Replacement of the traditional spherical sonar array with a conformal bow array will introduce an unprecedented degree of submarine architectural design flexibility. The hull coating to facilitate the installation of CAVES also improves stealth. A CAVES array is installed on USS *Newport News* (SSN 750) for at-sea testing starting in fiscal year 2001. CAVES is in the baseline for the *Virginia* (SSN 774) Class hull number 5.

The **Photonics Mast (AN/BVS-1)** provides color, high resolution and infrared imaging, laser rangefinding, image processing, communications, Global Positioning System, radar intercept and direction finding, as well as improved stealth characteristics to support submarine operations in the littoral.

Land Attack STANDARD Missile

Land Attack STANDARD Missile (LASM) is an evolution of the STANDARD Missile-2 (SM-2) family that incorporates a proven global positioning system/inertial navigation system for precision accuracy against targets ashore. LASM will provide the Aegis Fleet with a near-term, low cost land attack missile capability to meet Naval Surface Fire Support mission requirements. PEO Theater Surface Combatants is responsible for acquisition and life cycle support planning.

The LASM program was granted a Milestone I/II Decision in March 2000. An engineering and manufacturing development contract was awarded in July, the Preliminary Design Review was held in August, the Test Evaluation Master Plan was signed in September, and an Integrated Baseline Review was scheduled in December.

Lightweight Broadband Variable Depth Sonar Development

NAVSEA's NUWC Newport, in conjunction with its industry partner, Lockheed Martin Naval Electronics and Surveillance System, is developing the Lightweight Broadband Variable Depth Sonar (LVBDS) for an at-sea demonstration. With the successful outcome of a tank test performed at NSWC Carderock's tow tank, structural analysis, detailed design, and fabrication of the tow body were transitioned to Newport. The actual fabrication is being accomplished as a joint effort with Seeman Composites and NUWC's machine shops, with final tow body assembly at the NUWC Newport facility. The LBVDS demonstration sea test will be conducted on the R/V *Knorr*, the Woods Hole Oceanographic Institute research vessel, off the coast of South Carolina in September and October 2001. The entire LBVDS hardware and software suite will be installed on the R/V *Knorr* after complete system integration and calibration at NUWC Newport's Seneca Lake Test facility in the third quarter of fiscal year 2001.

LPD 17 Propeller Hub Test Program

During 2000, NAVSEA's Hydrodynamics Group and NSWC Carderock successfully completed a propeller design and evaluation program for the *San Antonio* (LPD 17) Class amphibious transport dock ship. The new ship class has twin 16-foot controllable pitch propellers, each with an advanced small diameter hub. The hub and blades, manufactured of nickel-aluminum-bronze and steel, constitute a unique design. The hub has a smaller diameter than past designs, leaving less surface for attaching the five blades and increasing stress in the blade root area and the hub.

The hub, along with the blade attachment bolts, underwent successful full scale static and cyclic testing. Full ahead and turning loads were applied simulating 14 years of operation. The testing, conducted at NSWC Carderock, represented the most extensive land-based testing of a controllable pitch propeller hub ever conducted for a U.S. Navy ship. The tests verified that the

Hub and blades of the propeller designed for the San Antonio *(LPD 17) Class.*

At-sea testing of the Remote Minehunting System.

new, compact design for the LPD 17 controllable pitch propeller makes it possible to extend the period between overhauls from 7 to 14 years, resulting in lower costs, easier maintenance and faster upgrades, i.e., an affordable propeller with enhanced performance for the modern Navy.

Propellant Development

NAVSEA's NSWC Indian Head researches and develops explosives and propellants for the Department of Defense. In 2000 the area of nitramine gun propellants was extremely active, with experts manufacturing nearly 50,000 pounds of propellants in support of such programs as Naval Surface Fire Support, extended range guided munitions, cargo projectile, and barrage projectile. A significant milestone was also reached: the formal Navy final qualification of EX 99 propellant.

The future in energetics manufacturing technology is in continuous processing. Research has proven that continuous processing is a cost-effective, safer, and environmentally sound process for some product lines. To this end, NSWC Indian Head broke ground in September 2000 for a new $6.59 million Continuous Processing Scale-Up Facility. The total investment in this new technology using the new facility is $35 million.

AN/UYQ-70

NAVSEA recently completed a successful joint venture demonstration of a network centric Q-70 variant with the Space and Naval Warfare Systems Command and the Third Fleet. The network centric Q-70 affords Sailors and Marines the ability to detect and visualize potential threats simultaneously from multiple sensors, and will serve as the "linchpin" for the Navy's Information Technology 21st Century initiative. Deployed as an integral component of the Sea-Based Battle Lab onboard USS *Coronado* (AGF 11), the network centric Q-70 represents a watershed achievement for real-time display of the battlefield environment.

With almost 2,000 units ordered thus far, the Q-70 has received wide acceptance. During 2000 and carrying into 2001, the network centric Q-70 was be deployed with the USS *George Washington* (CVN 73) Integrated Communication System, and will be touting even greater capabilities, including three-dimensional audio and video.

Remote Minehunting System

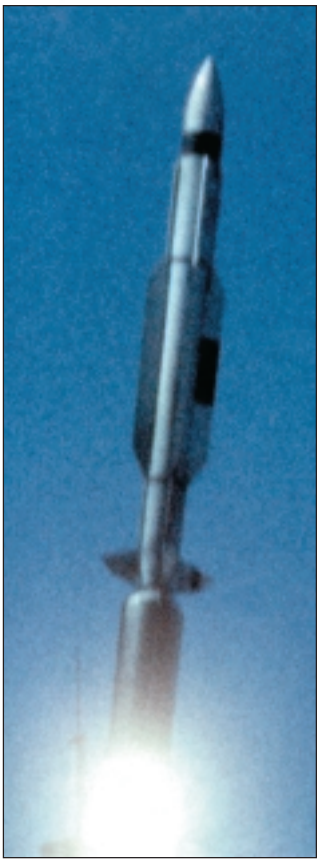
Currently in engineering and manufacturing development, the Remote Minehunting System (RMS) AN/WLD-1 is a high endurance, off board system operated and maintained from surface ships. The RMS will provide organic mine reconnaissance capability to *Arleigh Burke* (DDG 51) Class ships. The first hull to receive the RMS will be USS *Pinckney* (DDG 91). The system incorporates a 23 foot long, 4-foot diameter, 13,000 pound diesel powered semi-submersible vehicle which tows a variable depth sensor (VDS). RMS will conduct high-confidence mine field reconnaissance enabling ships to operate in or avoid specific areas.

RMS received Milestone II approval for engineering development and successfully completed system design review in December 1999. First phase critical item testing occurred from May to July 2000 off Palm Beach, Florida, using an existing prototype vehicle to reduce program risk and to support Preliminary Design Review (PDR). Testing successfully demonstrated RMS vehicle stability and control; underway launch and recovery; and speed and endurance. At-sea testing entailed more than 144 hours of operations across 28 days. Major accomplishments included: 19 launch and recovery cycles; stable, controllable flight in excess of 17 knots; and simulated VDS towing. A successful PDR was completed in October 2000. PEO Mine and Undersea Warfare is responsible for acquisition and life cycle support planning.

Navy Theater Wide Theater Ballistic Missile Defense

The Navy Theater Wide (NTW) Theater Ballistic Missile Defense (TBMD) system provides timely and extensive protection against medium/long range Theater Ballistic Missiles (TBMs) to Joint/Coalition Forces, sea and air lines of communication, command and control nodes, vital political and military assets, supporting infrastructures, population centers, and entire geographic regions. Operating in international waters, forward-deployed ships equipped with the NTW TBMD system have the capability to engage TBMs early in their ballistic missile trajectory. Ships equipped with an NTW TBMD system provide defense-in-depth along the threat trajectory. Multiple ships operating in mutual support are capable of providing the layered defense and overlapping coverage that leads to improved levels of force and unit protection across all mission areas.

The Navy strategy for TBMD development calls for the evolution of the existing Aegis weapon system, STANDARD missile (SM), vertical launching system, and battle management, command, control, communication, computers, and intelligence systems. This evolutionary approach leverages previous investments and takes advantage of already existing trained crews, industrial capability, engineering support, and previously developed assets such as the Lightweight Exo-Atmospheric Projectile (LEAP). The approach for NTW TBMD consists of three distinct portions. First, the Aegis LEAP Intercept (ALI) project will be completed with successful exo-atmospheric intercepts. Secondly, an initial Block I capability, divided into three smaller developmental increments (Block IA, Block IB, and Block IC), will be developed consisting of the ALI missile with computer program modifications and Aegis weapon system modifications to support the deployment of the Block I system. This Block I capability will counter the preponderant near term threat. Finally, the NTW TBMD Block II capability will be developed and deployed with enhanced discrimination and lethality capabilities.

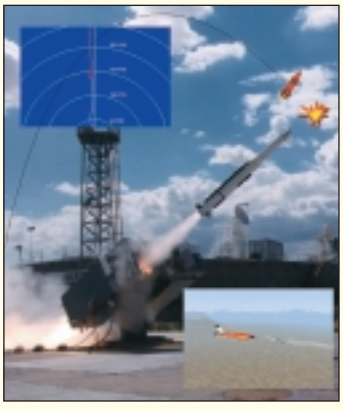


Launch of FTR-1 from USS Lake Erie *(CG 70) in July 2000.*

In 2000, the NTW TBMD program continued to focus on the two scheduled ALI Flight Test Round (FTR) launches. The primary objectives for the first of these flights, FTR-1, were to demonstrate third stage rocket motor (TSRM) guidance, nose cone separation, seeker calibration, and kinetic warhead ejection. The TSRM successfully completed all qualification firings and environmental testing, and was deemed safe for shipboard use in June 2000. Additional successes in ALI seeker performance in infrared acquisition tracking, radio frequency/infrared NTW prototype correlation algorithms, and SM-3 missile computer-in-the-loop guidance performance were gained through participation in the Pacific Blitz TBMD exercise.

Although the launch of FTR-1 in

Integrated video and graphical display technologies. The Naval Warfare Assessment Station (NAVSEA Corona) has developed video and graphical display techniques to provide a 3-dimensional representation of missile and target intercept geometries of launches of STANDARD missile, RAM, ESSM, and other missiles from surface combatants. Missile launch, flight, and intercept phases are displayed to determine if test objectives have been met and to provide assessment feedback from "real world" events. Simulated and live data are used to provide a graphic rendering of end game results with specific application to determine predicted and actual warhead performance.



July 2000 from USS *Lake Erie* (CG 70) at the Pacific Missile Range Facility, Hawaii, did not meet its primary objective due to a mission sequence anomaly, root/probable cause was identified, corrective actions were initiated, two independent assessment teams were chartered to conduct design review, and a re-shoot of the mission has been scheduled.

Navy Area Theater Ballistic Missile Defense

The Navy Area Theater Ballistic Missile Defense (TBMD) system will defend United States and Allied Forces, as well as areas of vital national interest, against tactical ballistic missiles (TBMs). It will be the Navy's first tactical missile defense system deployed to protect the forward positioned troops that are currently standing guard against points of debarkation, essential airfields, and seaports necessary to maintain peace throughout the world. Aegis cruisers and destroyers, equipped with a modified Aegis combat system, will detect and track short to medium range TBMs and engage them with the STANDARD Missile-2 (SM-2) Block IVA missile. The Navy Area TBMD program builds upon the well-proven SM-2 missile family and the Aegis weapon system including its vertical launch capability.

The year 2000 was a highly successful year in which the program accomplished major test milestones required to continue the road to deployment. These events were critical in validating lethality projections for the Navy Area TBMD program and in determining aerodynamic effects of a direct hit kinetic kill.

In conjunction with the Commander Third Fleet, NAVSEA successfully conducted the Pacific Blitz TBMD exercise as part of the ongoing RIMPAC 2000 Fleet exercise at the Pacific Missile Range Facility in June in Kauai, Hawaii. Pacific Blitz provided valuable feedback and substantially advanced the Navy's progress toward developing a Navy TBMD capability. The exercise reinforced the Department of Defense's efforts to achieve a fully interoperable anti-air warfare and TBM defense, and included Joint Service participation by the Navy, Army, Air Force, and Marine Corps.

The SM-2 Block IVA TBMD and anti-air warfare multi-role missile began flight testing at the White Sands Missile Range, New Mexico, with two Control Test Vehicle (CTV) flights. These two successful tests, CTV-1 and CTV-2, occurring in June and August, respectively, were the first two in a planned series of eight engineering and manufacturing development land-based flight tests.

The Navy Area TBMD program successfully completed the final test in a series of nine warhead sled tests at the High Speed Test Track facility at Holloman Air Force Base, New Mexico, in November. The series is part of the SM-2 Block IVA Live Fire Test and Evaluation Program which has successfully demonstrated SM-2 Block IVA lethality against TBM threats. This final test was conducted to demonstrate the lethality of the SM-2 Block IVA warhead against three different simulated chemical payloads of the type carried by tactical ballistic missiles.

USNS Mary Sears *(TAGS 65) christening.*

Naval Sea Systems Command

Engineering for the Navy After Next

NAVSEA

NAVAL SEA SYSTEMS COMMAND

Keeping America's Navy #1 in the World

America's strength and superpower status remain solid because organizations like NAVSEA can multi-task, working on today's readiness, tomorrow's preparedness, and the Navy after next engineering. America's naval strength will experience tremendous advancements in the future.

Zumwalt Class Land Attack Destroyer (DD 21)

The Navy's 21st Century land attack destroyer, DD 21, is a multi-mission ship being designed specifically to support Joint warfighting requirements in littoral environments. Named in honor of former Chief of Naval Operations Admiral Elmo R. "Bud" Zumwalt, Jr., in a July 4, 2000, ceremony, *Zumwalt* Class ships will focus on land attack warfare and will be able to

operate independently or as an integral component of a Joint Task Force. The ships will provide an unprecedented level of offensive, distributed, and precision firepower with weapons such as the Advanced Land Attack Missile (ALAM) and the Advanced Gun System (AGS) which will fire Long Range Land Attack Projectiles (LRLAP). Their arsenal of advanced surface strike weapons will provide Naval or Joint Force Commanders with significantly improved range, accuracy, and volume of fires compared to the current generation of shipboard surface fire support systems.

In September 2000, the Navy, through PEO Surface Strike, released the DD 21's Phase III through V Request for Proposal. The DD 21 is being designed by two competing industry teams, a "Blue Team" led by General Dynamics' Bath Iron Works with Lockheed Martin and Northrop Grumman, and a "Gold Team" led by Litton-Ingalls Shipbuilding with Raytheon Electronics and Boeing. The teams are addressing both total systems design and life-cycle engineering and support concepts in their proposals.

Selection of a single design and a full-service contractor for the new *Zumwalt* Class is planned for 2001; construction of the first ship is slated for fiscal year 2005. The first DD 21 will be delivered to the Fleet in fiscal year 2010, with initial operational capability (IOC) in fiscal year 2011. The Navy plans to build 32 *Zumwalt* Class destroyers, which will replace the *Oliver Hazard Perry* (FFG 7) Class frigates and the *Spruance* (DD 963) Class destroyers as they retire.

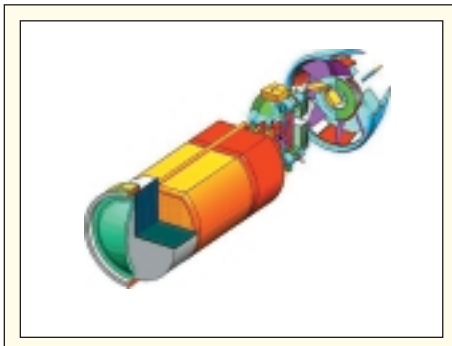
The DD 21 program is pursuing a myriad of technological innovations: optimal manning through advanced automation technology; modularity and commonality as a basis for affordable warships; an integrated power system that offers unprecedented design flexibility and warfighting capability; a new multifunction radar optimized for littoral environments; and advanced signatures management to minimize enemy detection and, to a large degree, maximize the ship's offensive and defensive capabilities.

Integrated Power System

During a nationally televised press conference in January 2000, Secretary of the Navy Richard Danzig announced that the DD 21 (*Zumwalt* Class) land attack destroyer will be the Navy's first class of ships designed and operated with an Integrated Power System (IPS) architecture and electric-drive propulsion. This revolutionary milestone, representing decades of scientific research, was acknowledged based on the understanding that both competing DD 21 industry teams had proposed IPS as part of their total ship system designs.

IPS incorporates electric propulsion and ship service electrical distribution into a single integrated system, allowing power to be sent where it is needed. The efficient use of power with IPS will result in significant fuel and maintenance savings, as well as increased flexibility for future design modifications and weapon system upgrades through rapid technology insertion as existing hardware becomes obsolete.

After more than a decade of research, the introduction of IPS provides several improvements compared to a segregated conventional mechanical drive configuration: (1) The cost of ownership will be greatly reduced due to the smaller number of prime movers installed. (2) The ability to selectively operate those prime movers in the most fuel efficient manner will be possible. (3) DD 21's survivability will be greatly improved. For example, if the ship suffers damage, the highly automated system will be able to instantaneously reroute power



Semi-fuel cell for UUV applications—a conceptual 3-D model. Researchers at NUWC Newport, funded by the Office of Naval Research, have demonstrated high-energy electric power sources to propel unmanned undersea vehicles (UUVs) for the Navy of the future. These power sources—semi-fuel cells—combine features of a fuel cell and a standard battery, and will provide a less expensive and safer source of power with four to six times as much energy as current silver-zinc batteries.

around affected areas and reconfigure systems so that the ship can continue to fight. (4) IPS offers much more flexibility with respect to Naval architecture and space arrangements.

Electro-Optic Imaging Technology

The prototype Shallow Water Real-Time Imaging Polarimeter (SHRIMP) is an electro-optic imaging device that can simultaneously image an object and measure the degree of polarization of light received from that imaged object. NAVSEA's NSWC Panama City will conduct both laboratory and at-sea tests of SHRIMP in order to determine the utility of partial linear polarization signatures for identification of underwater obstacles and mines, especially within the very shallow water regime. Testing occurred during fiscal year 2000 and will continue in fiscal year 2001. Analysis and report preparation will be completed in 2001. Shown: SHRIMP sensor in underwater housing.

Advanced Gun System

The Advanced Gun System (AGS) is the heart of the DD 21's land-attack arsenal and a key element of the system designs. Currently in engineering, manufacturing, and development by United Defense Limited Partnership, the AGS is a large caliber (155-mm) gun weapon system that will provide high-volume, sustainable fires with precision accuracy in support of amphibious or Joint land operations. After careful consideration, both DD 21 industry design teams—i.e., the Blue Team and the Gold Team—agreed to develop two trainable, single-barrel 155-mm guns with integrated gun and fire control systems and automated magazines. Each gun will be able to fire up to 12 rounds per minute and store between 600-750 rounds. AGS development includes a full family of munitions, including the 155-mm Long Range Land Attack Projectile (LRLAP). The gun system is also being designed to meet the optimized manning and low radar-signature requirements of DD 21.

Affordability Through Commonality

The Affordability Through Commonality (ATC) Program (PMS 512) promotes and enables Total Open System Architecture (TOSA) solutions that result in affordable Fleet-wide mission, technology, and market adaptability. TOSA currently supports the DD 21, JCC(X), and CG 47 Conversion Programs with an Integrated Process Team composed of Navy and industry personnel, including Ingalls Shipbuilding, Bath Iron Works, and other commercial companies.

The TOSA approach manages the increased use of commercial-off-the-shelf (COTS) equipment on ships, while supporting upgradability in anticipation of technology insertion. This program is in response to: (1) longer ship service lives, (2) increased use of COTS technologies that have shorter lifecycles, (3) need for systems adaptability to technology insertion driven by advances, and (4) desired increase market competition for systems, components, equipment.

Optimized Manning

Key to DD 21 manning plans, the Optimized Manning (OM) Program coordinates cross-program human factors, manpower, personnel, and training issues with other PEOs, systems commands, and activities, and establishes new manpower determination models that capture life-cycle impacts of manning decisions and enable proper tradeoffs in the design process. It investigates and plans crew manning and operations, and supports cost reductions by engineering human performance into the system. The effort is to provide 21st Century Sailors with an optimal working environment and unprecedented habitability improvements designed to raise their quality of shipboard service.

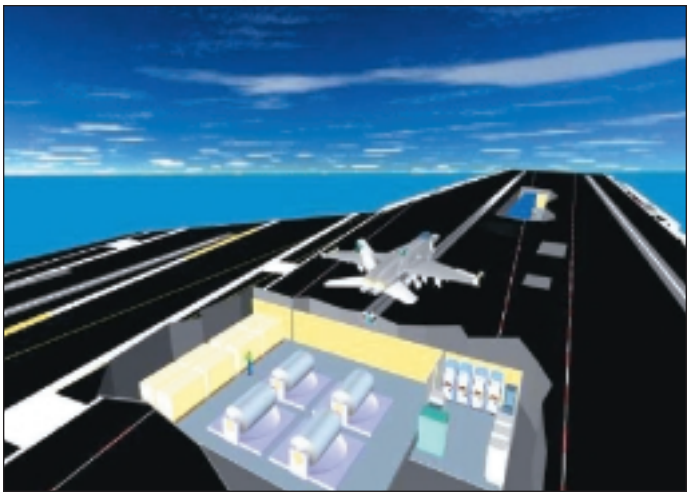
Advanced Land Attack Missile

Planned by PEO Surface Strike, the Advanced Land Attack Missile (ALAM) Program was established to fulfill Navy and Marine Corps surface strike requirements to a range beyond 200 nautical miles. The new missile will provide precision strike capability with the range, lethality, and responsiveness required to support the *Marines Corps Strategy 21* and the corresponding *Operational Maneuver From the Sea* concepts. ALAM will be designed to destroy a variety of target sets including moving, armored, and bunkered targets.

ALAM received Milestone 0 approval in February 2000. An ALAM Analysis of Alternatives (AOA) is evaluating a broad array of potential solutions to fill a current land attack range/responsiveness void for neutralizing time-critical targets. The ALAM AOA will be completed in Fiscal Year 2001 to ensure timely support of DD 21 which begins construction in Fiscal Year 2005. ALAM also may be backfitted into both Aegis ships and submarines. Program planning, technical challenges, specific operational concepts, and budget requirements are all dependent on the recommended ALAM alternative.

CVNX

The next class of aircraft carriers, CVNX, as planned by PEO Aircraft Carriers, will be designed using an evolutionary, multiship process for inserting new technologies. CVNX 1, the first of the new class, will include the CVN 77 warfare system, and a new nuclear propulsion plant, electrical system, and Electromagnetic Aircraft Launch System providing immediate warfighting enhancements, substantially reduced total ownership costs, and the critical enabler for future technologies. CVNX 2 will incorporate the improvements of CVN 77 and CVNX 1, and will focus on survivability and flight deck improvements as well as distributive systems and functional rearrangement to significantly improve warfighting capability, restore service life allowances, and reduce life cycle costs. The Joint Requirements Oversight Council review board approved the CVNX Operational Requirements Document in February



The Electromagnetic Aircraft Launch System (EMALS) will first be used on the new CVNX Class aircraft carrier.

2000; the Defense Acquisition Board Readiness Meeting was conducted in May 2000. Subsequently, the Under Secretary for Defense/Acquisition and Technology approved Milestone I and initiation of the Program Definition and Risk Reduction Phase for the CVNX program. The Navy then awarded an integrated product and process development contract to Newport News Shipbuilding for CVNX functional design and development.

Land Mine Detection Illumination Technology

NAVSEA has developed two new illumination technologies. One is a Small Business Innovative Research (SBIR)-developed Phase II prototype hybrid laser designed to provide four simultaneous range-gated outputs for imaging at night and through obscurants or water. The other, a stacked Laser Diode Array Illuminator, is an ultra-compact, high-efficiency light source developed to enhance nighttime operations. The illuminators will be mated with various imaging sensors, including the tunable filter multispectral camera, to enhance overall mine detection at night, in the surf zone, through battlefield obscurants, and in difficult backgrounds to provide enhanced reconnaissance information in real-time.

Revolutionary Electronic Components and Nanodevices

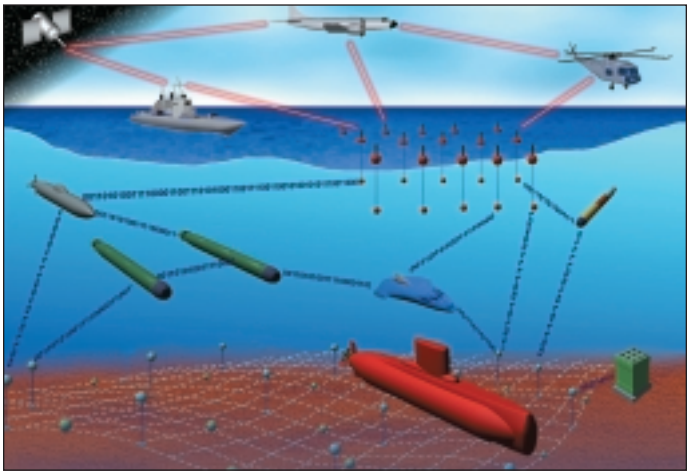
NAVSEA's NSWC Dahlgren has developed a new materials manufacturing process called compliant substrate engineering. Using a molecular beam epitaxy technique, surfaces of materials are chemically modified in special chemical environments inside a vacuum. This environment allows the reacting surface to be exposed to an extremely small number of molecules of the reactant, resulting in the production of chemical compounds not possible in any other chemical environment. These new chemical compounds will have new physical properties that will enable the Navy to develop revolutionary technologies for surface combatants.

NSWC Dahlgren is currently developing two technological applications using this novel approach. The first is the BaF_2/GaAs metal insulator semiconductor field effect transistor, which will enable the Navy to develop power-efficient solid-state radar and compatible digital computer orders of magnitude faster than current silicon technology. The second application is the development of non-linear infrared/optical charge couple devices. These devices will allow the Navy to develop decoy-proof track and search systems both in the optical and infrared domains. Additionally, compliant substrate engineering is one of the most promising approaches to the systems integration of nanotechnology and conventional microelectronics. Such integration will accelerate the implementation of truly revolutionary devices made out of nanodevices, such as molecular computers, to the Fleet.

Network-Centric Warfare

Littoral operations against threats in shallow water are an important area of focus for the research and development resources of our undersea warfare community. A commander must be able to provide his forces with consistent knowledge of where platforms (friend or foe) are and what they are doing, and he must be able to quickly neutralize threats in or approaching the battlespace without harm to friendly forces. This kind of coordination requires sophisticated networks that integrate all sensors, shooters, command nodes, and combat systems such that information can be exchanged in near real-time. Network-Centric Warfare and the concept of controlling the battlespace have emerged as technology drivers.

One of NAVSEA's primary challenges is to develop capabilities that permit the Submarine Force to continue to avoid detection while exchanging vast amounts of data. NUWC Newport is investigating various options for antennas (e.g., built-in/conformal planar sail arrays and deployable antennas) as potential sources to provide the needed throughput capacity while maintaining stealth. In addition, NUWC Newport is investigating acoustic and other underwater communication systems to provide two-way communication at all operating depths. The advancement of sensor technology and the development of off-board sensors will also be key to populating the undersea network, providing a wealth of reconfigurable assets that can be easily integrated into the battlespace and expand the role of undersea warfare for the future.



Artist's conception of Network-Centric Warfare.

Submarines—The Road Ahead

The Submarine Future Studies Group (FSG) and follow-on Strategic Concepts Working Groups assessed potential submarine tasks for the 2020 timeframe based on evolving naval concepts and effects-based warfare. Stealth, endurance, agility, and firepower will continue to be crucial to future Submarine Force contributions to national and naval strategies, especially the ability to conduct guerrilla warfare and reconfigure for missions. The FSG assessment developed submarine joint strategic concepts for a spectrum of operations, including Gain and Sustain Battle Force Access, Develop and Share Knowledge, Project Power with Surprise from Close-In, and Deter and Counter Weapons of Mass Destruction. These concepts provide a framework which will be used to shape submarine technology investment recommendations.

Unmanned Undersea Vehicles

The submarine of the future must perform as a fully integrated and critical component of the battle force, fulfilling all required missions, in all environments. One key ingredient in this vision is the Unmanned Undersea Vehicle (UUV), an unmanned submersible that will greatly expand a submarine's capability and sphere of battlespace dominance. The future maritime environment shows a stretched asset base, a more capable threat, less tolerance for losses, and more operation in the cluttered littoral. The UUV master plan, approved in April 2000, will help the Navy meet these challenges. Future UUV demonstrations will include maritime reconnaissance, undersea search and survey, communication/navigation aid and relay, and submarine track and trail.

Artist's conception of a MANTA concept vehicle.

NUWC Newport is working with a family of UUV testbeds. Remote Environmental Monitoring Units (REMUS) performed 46 in-water runs during fiscal year 2000. The 21-inch UUV also performed multiple in-water runs to demonstrate a variety of technologies. The MANTA Test Vehicle (MTV), a 1/3-scale prototype vehicle to demonstrate the capabilities of the MANTA, an advanced-concept UUV, completed 14 in-water runs during fiscal year 2000. These runs verified vehicle controllability, as well as communication and surveillance payload testing. During the September 2000 run, remote users aboard USS *Providence* (SSN 719) in Groton, Connecticut, were able to communicate with the MTV running in a representative shallow water operating area in Newport, Rhode Island.

In very shallow water, defined as 10 to 40 feet deep, the UUV will greatly improve the Navy's explosive ordnance disposal (EOD) and Special Warfare Forces capabilities to rapidly and safely search and neutralize mines in advance of amphibious ship-to-shore operations. NSWC Coastal Systems Station was host to the mine warfare portion of Fleet Battle Experiment—HOTEL in August 2000. Components of EOD Mobile Unit 6, Helicopter Squadrons 14 and 15, and three MCM-1 class ships operated in conjunction with multiple UUV technology concept demonstrations, sponsored by the Office of Naval Research, to conduct mine countermeasures operations in the Gulf of Mexico off Panama City, Florida.

Advanced Transduction Material Arrays

Most existing sonar transducer technologies that are capable of producing the acoustic signals required for future Navy needs are only conceptual in design, or very early in their development stage. To deal with the harsh acoustic conditions encountered in shallow water environments, transducers must be designed to provide significantly more resolution than is required for open ocean antisubmarine warfare. Improvements in resolution can be gained by increasing the bandwidth of the transducers in the sonar array. Bandwidth is directly related to the electromechanical coupling of the active transducer material. Recent material advances have led to the development of a class of electroactive single crystals (i.e., piezocrystals), that have extraordinarily high values of electromechanical coupling.

NAVSEA's NUWC is engineering the Fleet's future high performance weapons systems' sonar arrays by incorporating material advances into torpedo homing transducers. Because simple substitution of higher coupling piezocrystals into existing ceramic transducers will not result in increased bandwidth, NUWC has redesigned the transducer to take advantage of the material properties. During underwater testing, the new transducer provided a significant performance improvement which can be translated into revolutionary sonar systems performance.

Micro-Electrical Mechanical Systems

Micro-Electrical Mechanical Systems (MEMS) devices are rapidly emerging in a multitude of commercial applications in communications, the automotive industry, the biomedical field, and industrial plant manufacturing process control systems. MEMS technology is about miniaturizing complex electromechanical devices, which involves combining sensing and actuating capabilities on a single silicon chip. NAVSEA's NSWC Indian Head Division has taken a leadership role in the last five years to develop MEMS technology for Navy weapons.

The next generation of underwater weapons will require fuze safe and arming (S&A) controls to be safer, smaller, and more capable. MEMS is the technology that will allow NAVSEA to meet Fleet requirements for a fuze S&A that is 10 times smaller, more capable, and more reliable, and that has a lower life cycle cost and potential applications for a wide range of Navy and Department of Defense weapons. NAVSEA's MEMS efforts reached a significant milestone in August 2000 when in-water demonstrations of the MEMS S&A were conducted. The MEMS S&A prototype demonstrated its ability to operate in full-scale torpedo conditions and environments.

Because MEMS is a driving technology, NAVSEA has invested in a new facility called a MEMS Clean Room. This 21st century research and prototyping facility, part of NSWC Indian Head, is dedicated to the assembly, packaging, and testing of MEMS systems that contain propellants and explosives. It is believed to be the only one of its kind in the world.

Joint Department of Defence / International Efforts

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The battlespace of the future will inherently belong to the Joint warfighter. Thus, the interoperability between command and control systems and weapon systems will be paramount to the success of Allied or combined forces. The dominance of these systems, and the ability to ensure interoperability, are all reasons for NAVSEA to aggressively pursue working relationships with its sister military services and U.S. Allies around the world.

Joint Department of Defense Efforts

Lightweight Disposable Disrupter

The Lightweight Disposable Disrupter (LIDD), is a joint service explosive ordnance disposal tool which was developed and patented by the Naval Explosive Ordnance Disposal Technology Division, Indian Head, Maryland. Army, Air Force, Navy, and Marine Corps explosive ordnance disposal (EOD) technicians will use LIDD to render safe or disrupt unexploded ordnance with minimal set-up time and time-on-target. Consisting of an energetic tool and an emplacement stand, LIDD enables technicians to attack multiple unexploded ordnance in a single EOD incident. The energetic tool contains a remotely initiated explosive charge that accelerates a low velocity projectile. The emplacement stand enables the energetic tool to be placed in challenging orientations that might not otherwise be possible. LIDD, which will supplement existing EOD tools, is scheduled for full rate production in early 2001.

JLOTS

In conflict America's Navy and Army must be able to offload cargo quickly from ships anchored offshore to build and sustain fighting forces ashore. The Joint Logistics Over The Shore (JLOTS) focuses on containerships, roll-on/roll-off ships, heavy-lift barge carriers, semi-submersible ships, and deep draft tankers, which operate without the benefit of fixed port facilities.

Military technician using Lightweight Disposable Disrupter (LIDD).

NAVSEA's NSWC Carderock began this effort in the 1960s and remains in the forefront of JLOTS research and development. The military services have several R&D programs to develop new concepts and technologies that can be applied to existing and future sealift and merchant ships. R&D programs which are being managed at NSWC Carderock to support this effort include ship cargo movement systems; ship operations/interfaces; and training, command and control, and doctrine.

Reconnaissance, Surveillance, and Targeting Vehicle

United States Marine Corps small units, raid forces, and ground reconnaissance teams have a need for rapid, extended range, deep maneuver, in-ground mobility assets with firepower. As the Navy/Marine Corps team operates more extensively in the littoral environment, these mobility assets will require vertical transport. This calls for smaller, lighter, and more capable vehicles that must be internally transportable in the MV-22.

The aging M151-A2 Fast Attack Vehicle and the High Mobility Multipurpose Wheeled Vehicle (HMMWV) are approaching the end of their service lives. The HMMWV is incapable of internal transport in the MV-22, so the Reconnaissance, Surveillance, and Targeting Vehicle (RST-V) is being developed. It will evaluate future advanced power/propulsion, mobility, and survivability technologies, including being transportable internally in the MV-22.

These technologies include hybrid electric drive, signature management technologies, and integrated communications and sensor packages. NAVSEA's NSWC Carderock Division leads the technical development for the RST-V, which is jointly funded by the Defense Advanced Research Projects Agency and the Marine Corps through the Office of Naval Research.

Single Integrated Air Picture System Engineering Task Force

NAVSEA has provided senior leadership and initial staffing for the Single Integrated Air Picture System Engineering (SIAP SE) Task Force, which was established under the authority of the Secretary of Defense. Organized during 2000, it is critical to the Joint Chiefs of Staff. The Navy provides the lead for the task force; the Air Force provides the deputy lead and the Army serves as the acquisition executive. SIAP SE will execute oversight for system interoperability to achieve greater efficiencies in producing and fielding interoperable Joint forces in a more affordable, timely, and efficient manner.

The mission of the task force is to lead system engineering and acquisition efforts by implementing a disciplined process necessary to provide measurable improvement in warfighting capability leading to the fielding of a SIAP capability. The task force is responsible for developing policy and architecture for a SIAP system; implementing a common SIAP system engineering process for design, development, acquisition, integration, and testing; and providing direction for deployment, support, and disposal of a balanced SIAP system for all military service warfighting units.

Amphibian Suit

Under sponsorship of the Naval Science Advisor Program, NAVSEA teamed with the Soldier and Biological and Chemical Command, Natick, Massachusetts, and the U.S. Naval Academy to develop a lightweight exposure suit for amphibious operations. The objective is to develop a thin, lightweight, self-regulated, waterproof garment for Naval Special Warfare operators that would be suitable for both land and water operations. Using an elastomer-shape memory polymer, the garment will keep an operator dry and warm in the water but on the surface will let perspiration pass through the fabric for coolness. Results have been promising and the second phase of the effort will be conducted in 2001.

USCGC *Healy* Arctic Trial Support

NAVSEA teamed with the U.S. Coast Guard, the Arctic Icebreaking Coordinating Committee, the National Science Foundation, the Arctic Research Council, the University National Oceanographic Laboratories System, and others from academia throughout the world, to provide comprehensive testing and evaluation of the over 40 science systems on the Coast Guard's newest icebreaker, USCGC *Healy* (WAGB 20). Delivered at Litton/Avondale Industries, Inc. in November 1999, *Healy* will be used in scientific exploration of the Arctic.

NAVSEA's NSWC Dahlgren and Panama City Divisions led the successful tests of systems in the Puerto Rican Trench, and then in the high latitudes above and below the Arctic Circle. *Healy* performed superbly. One example: designed to back and ram through eight feet of ice, she instead was able to back and ram through 45 feet of ice.

USCGC Healy *during her ice trials in the Arctic. She is the first U.S. Government ship to sail the historic Northwest Passage in 20 years.*

Department of Defense Past Performance Automated Information Systems

The Naval Sea Logistics Center hosts and manages the Department of Defense Past Performance Automated Information System (PPAIS) for the Joint Electronic Commerce Program Office. The system was deployed in July 2000 and now contains over 8,000 report cards representing over $300 billion in contracting actions. This automated warehouse and retrieval application allows DoD source selection officials to enter one site to retrieve report card information on the performance of DoD contractors. More than 165 DoD users have accessed the system over 1,000 times to retrieve the data for source selection. PPAIS currently contains over 4,000 report cards from the Air Force (from the Air Force Materiel Command Contractor Performance Assessment Reporting

System), over 2,000 from the Navy (from the Navy's Contractor Performance Assessment and Reporting System), over 1,600 from the Defense Information Support Agency (from the DISA Past Performance Tool), and over 600 from the Army (from the Army's Past Performance Information Management System).

Area Air Defense Commander Capability

The Area Air Defense Commander (AADC) Capability is an advanced command and control system designed to plan, coordinate, and execute air defense operations in an integrated air defense environment in support of a Joint Task Force Commander's objectives. A 21st century battlespace management system designed to provide the Joint Forces Commander with a fully integrated air defense capability, the system uses computer technology to develop an air defense plan, including recommendations for tactical placement of air defense assets from land and sea. The system revolutionizes war planning by providing near real-time information to theater commanders in the form of a common tactical picture. AADC Capability production units are initially slated for installation aboard Aegis Class cruisers.

The ADDC Capability program realized some significant accomplishments in 2000. In July, General Dynamics Advanced Technology Systems was awarded a contract for the engineering and manufacturing development phase of the AADC Capability development. Throughout the year, NAVSEA worked to establish working agreements with other services to ensure that the AADC Capability is truly a Joint system. A number of Memorandums of Agreement have been signed with the other military services to ensure Joint interoperability, to enhance the probability of software reuse, and to significantly enhance joint warfighting capabilities.

Joint Navy/DARPA Submarine Payloads and Sensors Study

A key component of the long-term submarine technology management strategy, the Joint Navy/DARPA Submarine Payloads and Sensors program 18-month study developed innovative concepts that address payloads, sensors, and platforms for major advances in the operational impact of future submarines. Selected technology concepts will be further developed and then demonstrated with funding provided by NAVSEA.

International Efforts

Security Assistance / Foreign Military Sales

NAVSEA executes its role in support of U.S. foreign policy by providing operationally effective and affordable products and services, consistent with security assistance policy and customer needs, through the transfer of military and economic assistance. This is accomplished via sale, lease, grant or loan of ships, systems, munitions, and technical/logistic support furthering foreign policy goals, enhancing interoperability with Allies, and helping maintain the U.S. ship construction, modernization, and repair infrastructure needed to support U.S. Navy ships.

A recent initiative consistent with the reinvention of the Foreign Military Sales (FMS) process was the establishment of the Ship Transfer Rapid Improvement Team (RIT). The RIT charter was successful in rewriting the Ship Transfer Instruction which, once fully implemented, should accelerate the FMS Ship Transfer process and reduce costs to foreign navies through improvements in the cycle-time efficiency and customer satisfaction.

NAVSEA managed over 1,200 FMS cases worth nearly $7 billion in 2000; new business totaled nearly $460 million. These government-to-government agreements provide military equipment and services to over 65 fleets around the world that include over 400 ships. Ship transfer work included successful ship transfers to Poland, Turkey, and Taiwan. The potential transfer of four *Kidd* Class destroyers is a major initiative for fiscal year 2001. Programs to expand worldwide deployment of Standard Missile 2 progressed in Korea, the Netherlands, Germany, and Italy. Also, contracts were signed for a new class of Norwegian frigates which will integrate commercially procured Aegis hardware with classified software being procured through FMS, a trend becoming increasingly prevalent in today's environment.

Aegis Frigate Program

In 2000, NAVSEA successfully delivered Aegis combat system equipment in support of the Spanish Navy F100 Aegis Frigate Program. The F101 *Álvaro Bazán*, the first Aegis frigate in the world, was launched at Ferrol, Spain, in October. The F100 program represents the culmination of successful cooperation between the U.S. Navy and the Spanish Navy, and industrial cooperation agreements among industry partners in the U.S. and Europe. Three additional Spanish frigates will be similarly outfitted and launched within the next three years.

Certification of Foreign Submarines For DSRV/SRC Rescue

For the past several years, the U.S. Navy has been working with various foreign countries to enable their submarines to operate with or be rescued by the U.S. Navy's Deep Submergence Rescue Vehicle (DSRV)/Submarine Rescue Chamber (SRC) should an emergency occur.

Through the International Programs Office, NAVSEA has conducted on-site inspections, performed and reviewed strength analyses, and reviewed fabrication and material documentation for submarines from various foreign countries. Unique features of each submarine which would be of interest to DSRV and SRC operators and pilots have been noted. In addition, the Deep Submergence Unit (DSU) San Diego has reviewed logistics considerations associated with transporting the DSRV and SRC to potential sites in foreign countries.

In 2000, certification efforts supported two submarine rescue exercises: Sorbet Royal 2000 (with Italy and Turkey) and Pacific Reach (with Singapore, South Korea, and Japan). Rescue certification has been completed for a number of submarines from Canada, France, Israel, Italy, Japan, South Korea,

the Netherlands, Singapore, Taiwan, Turkey, and the United Kingdom. Work is in progress for submarines from Australia, Brazil, Denmark, France, India, Italy, South Korea, Norway, Japan, Pakistan, and Sweden.

The DSRV/SC program received media attention in 2000 as a result of the tragic loss by the Soviet navy of the submarine *Kursk*. The Soviet Union is not one of the countries which has participated in international rescue exercises to date.

U.K./U.S. Trimaran Demonstrator

The United States and the United Kingdom have a Memorandum of Understanding to embark on a collaborative project known as the U.K./U.S. Trimaran Demonstrator. The project consists of a 90-meter U.K. Trimaran ship and a sophisticated U.S. trials instrumentation system (TIS) which will be combined to form the instrumented Trimaran Demonstrator. Design and construction of the TIS is underway at NAVSEA's NSWC Carderock, where NAVSEA personnel provide oversight of the U.S. portion of the program. The Demonstrator has been designed to accommodate the U.S. Navy's Integrated Power System components and will be the at-sea test platform for the testing of this system.

The Triton *is the world's largest steel three-hulled vessel, or Trimaran.*

International Torpedo Cooperation

NAVSEA works closely with industry to provide the best heavyweight and lightweight torpedoes to international customers by providing information and numerous in-country briefings to foreign navies. Highlights in 2000 include Mk 48 ADCAP briefings to the Spanish and Portuguese Navies and Mk 46 SLEP briefings to the Japanese Maritime Self Defense Force and the Israeli Navy. Further, technology exchange discussions were held with both United Kingdom and Italian torpedo interests. Both Taiwan and the Netherlands decided to upgrade their current Mk 46 torpedo inventories to the SLEP configuration.

The continued collaboration between the United States and the United Kingdom in Surface Ship Torpedo Defense (SSTD) in 2000 resulted in initiating the joint development of upgrades to the AN/SLQ-25A NIXIE towed decoy torpedo countermeasure system. These upgrades provide improved capability against threat torpedoes and enhance the performance of the AN/SLQ-25A system in shallow water littoral operating areas. The performance improvements will be evaluated aboard a British warship in 2001. The combined efforts of the United States and the United Kingdom in SSTD are well recognized by other Allied countries, opening up opportunities for cooperative development of the next generation of SSTD improvements.

NATO FORACS

NATO Naval Forces Sensor and Weapon Accuracy Check Sites (FORACS) is a NATO project with Canada, Denmark, Germany, Greece, Italy, Norway, the United Kingdom, and the United States that operates three ship testing ranges that measure bearing, range, heading, and positional errors of shipboard radar and sonar. NATO FORACS Norway, NATO FORACS Greece, and NATO FORACS AUTEC are the three sites which tested 90 ships and submarines in 2000. All the sites have been upgraded with new NAVSEA-developed global positioning systems for on-range tracking and integrated data acquisition test systems for providing real-time data processing and test results.

NATO Naval Group 6 on Ship Design

NAVSEA provides the chairman for the NATO Naval Group 6 (NG/6) on Ship Design panel which consists of participants from Canada, Denmark, France, Germany, Italy, the Netherlands, Norway, Portugal, Spain, the United Kingdom, and the United States. The panel's unclassified technical discussions with Partnership for Peace (PfP) nations, including Bulgaria, Finland, Poland, Romania, Ukraine, and Sweden, have proved to be both extensive and positive.

NG/6 initiatives presently underway include a simulation-based design and virtual prototyping specialist team, a ship cost reduction panel, a NATO Industrial Advisory Group, and PfP pre-feasibility studies on "Survivability Design Related to Fire Resistance" and "All Electric Ship."

NATO SEASPARROW

The NATO SEASPARROW Consortium, comprised of 13 participating nations, is NATO's largest and most successful cooperative weapons project. As the Consortium completes its 31st year of cooperative development, production, and logistics support, the NATO SEASPARROW Project is positioning itself to expand the scope of cooperation to meet future ship self-defense requirements. A new missile, the Evolved SEASPARROW Missile (ESSM), is being developed to counter the anti-ship cruise missile threats and is well into test and evaluation. ESSM is scheduled for ship self-defense aboard the *Arleigh Burke* (DDG 51) Class Flight IIA Aegis destroyers, and U.S. aircraft carriers and amphibious assault ships, as well as high-value Allied ships in the NATO Fleet.

The standard Mk 57 NATO SEASPARROW Surface Missile System serves as the primary ship self defense system aboard more than 50 U.S. Navy ships. This system is undergo-

ing a modernization program that includes a system rearchitecture program to increase reliability, survivability and availability; reduce watchstation requirements; and decrease operational and maintenance costs. Utilization of commercial-off-the-shelf technology and open system architecture is playing a prominent role in modernizing the NATO SEASPARROW weapon system to keep it battle-ready for the 21st century.

Expanded Mine Ship Overseas Presence

The surface mine countermeasures Fleet expanded their overseas presence during 2000. Having been forward deployed in the Arabian Gulf region over recent years, two *Avenger* (MCM 1) Class ships, USS *Ardent* (MCM 12) and USS *Dextrous* (MCM 13), were formally homeported at Manama, Bahrain, in March and June 2000, respectively. Two other mine countermeasure ships remained homeported at Sasebo, Japan.

A contract was awarded in June 2000 to Offshore Heavy Transport of Oslo, Norway, for heavy lifting two coastal minehunter—*Osprey* (MHC 51) Class—ships from their Ingleside, Texas, homeport to Bahrain aboard the motor vessel, *Blue Marlin*. USS *Cardinal* (MCH 60) and USS *Raven* (MHC 61) were landed on *Blue Marlin* on July 22, departed July 27, and arrived in Bahrain on schedule on August 28. On September 1, 2000, they became the first ships of their class to be homeported overseas.

The coastal minehunter ships USS Cardinal *(MHC 60) and USS* Raven *(MHC 61) aboard the Norwegian motor vessel* Blue Marlin *en route to their new homeport in Manama, Bahrain.*

The Rolling Airframe Missile

The Rolling Airframe Missile (RAM) is a lightweight, quick-reaction, high-firepower weapon system jointly developed by the U.S. and German governments. A "fire-and-forget" missile that does not require external guidance for target tracking and intercept, RAM is designed to counter anti-ship cruise missiles attacking in waves or in streams, diving or maneuvering.

In 2000, the RAM program experienced several significant events. In January, the Block 1 program received Milestone III approval allowing full rate missile production. The Block 1 upgrade adds an infrared (IR) all-the-way capability enabling the missile to engage non-radio frequency (RF) emitting cruise missiles as well as those exhibiting lowered IR signatures, multiple guidance modes, countermeasures, and improved passive guidance or intermittent RF emissions.

Third-party interest in RAM also gained momentum. In April 2000, the Hellenic Navy signed a direct commercial sales contract with German industry for three RAM launchers and, following a December 1999 contract for three RAM launchers, the Republic of South Korea signed an LOA for 64 RAM missiles in October 2000. Membership interest in the program is also high. To date, Spain, Turkey and Greece have expressed interest in joining the program as partners.

Environmental Efforts

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Throughout 2000, NAVSEA continued its legacy in responsible stewardship of our environment. We have reinforced our commitment to excellence in keeping our water and air clean, and strived to ensure that we design our products and manage our infrastructure in a responsible manner.

Hazardous Materials/Waste

NAVSEA is charged with developing and integrating into the Fleet shipboard systems and procedures that reduce and control shipboard wastes. The mission is two-fold: it allows Navy ships to comply with increasingly restrictive environmental laws and regulations, while at the same time it reduces burdensome environmental shipboard duties and protects the crew's safety and health. To accomplish this, NAVSEA develops shipboard waste management, hazardous material control and minimization, pollution prevention, and non-ozone depleting substance systems which are compatible with Naval operations. In addition to managing shipboard systems, NAVSEA also provides the necessary technical input for the development of the Uniform National Discharge Standards legislation.

Chlorofluorocarbon (CFC) and Halon Elimination Team

The CFC and Halon Elimination Team continues to lead in the effort to transition the Navy from ozone-depleting substances. The Fleet-wide conversion of shipboard CFC-12 air conditioning and refrigeration plants reached the 70 percent completion point. To date, over 655 of the approximate 925 CFC-12 plants have been converted, and 172 Navy ships are now "CFC-12-free." Prototype installations were completed on *Osprey* (MHC 51) Class air conditioning plants and *Ohio* (SSBN 726) Class refrigeration plants in 2000. The program converts the existing shipboard CFC-12 systems to operate with ozone-friendly HFC-134a.

Putting the finishing touches on an air conditioning plant conversion aboard USS Emory S. Land *(AS 39).*

The CFC-114 centrifugal compressor air conditioning plant conversion program has completed installations of 22 plants on six *Ticonderoga* (CG 47) Class ships to date, in addition to the first conversion of air conditioning plants on an *Arleigh Burke* (DDG 51) Class ship. A contract was awarded for the procurement of 363-ton air conditioning plant conversion kits used on aircraft carriers (CV/CVN). Under this contract, the first ship set of conversion kits has been procured for *Dwight D. Eisenhower* (CVN 69). The program plans to convert approximately 500 CFC-114 air conditioning plants to ozone-friendly refrigerant HFC-236fa by fiscal year 2013.

Solid Waste

To enhance the Fleet's ability to handle solid waste, NAVSEA began the installation of pulpers and shredders in 1999; installations continued in 2000. This equipment will enable ships to process non-plastics solid waste into an environmentally compatible form suitable for discharge anywhere in the world's oceans. To date, the pulpers and shredders have been installed on over 156 surface ships. The remaining installations are scheduled for fiscal year 2001.

A commercial-off-the-shelf medical waste processor (MWP)

has been successfully evaluated in the laboratory and on board ship The MWP compresses and sterilizes infectious medical waste, including needles and other "sharps," into small, unrecognizable disks encapsulated in white plastic. The automated, easy-to-operate machine is a much safer and more hygienic alternative to autoclaves, and reduces the waste volume by 80 percent.

A commercial incinerator has been modified to meet Navy shipboard requirements (e.g., size, shock, vibration) and is being tested in the laboratory at NSWC Carderock. The Solid Waste Advanced Incinerator is intended as a more flexible and reliable replacement for the manpower-intensive incinerator currently installed on aircraft carriers and amphibious ships that was designed in the 1950s and was used primarily to burn classified documents.

Oily Waste

NAVSEA continues to implement the certification process for Oil Pollution Abatement (OPA) equipment. This process ensures Fleet compliance with Department of Defense directives, resolves installation and system design deficiencies, updates technical documentation, and provides an opportunity for hands-on crew training. Begun in 1996, more than two-thirds of the Fleet has been certified.

In 2000 NAVSEA initiated the OPA Repair and Training Program to assist remaining ships with certification. Teams performed certifications on 13 ships of various classes to assess their material condition and determine the level of effort necessary to certify the remainder of the Fleet. Significant efforts were also initiated to upgrade high capacity oil water separators (OWSs) recently installed on aircraft carriers and amphibious class ships. Alterations were developed to improve systems' reliability and Fleet performance.

Non-Oily Wastewater

NAVSEA continued to provide support for Fleet sanitary waste systems. In 2000 the in-service engineer conducted certification inspections of the collection, holding, and transfer (CHT) systems, and the vacuum collection, holding, and transfer (VCHT) systems on nine ships. In addition to certifying the systems, the group also developed improvements. The most significant efforts were a Sanitary Waste System Holding Tank Flanged Level Sensor Replacement Test completion which will result in the installation of new magnetic float switches, and the development of new mechanical seals for sewage transfer pumps. Both modifications will increase system reliability and reduce crew maintenance burdens. New construction ships as well as ships already in the Fleet will receive the new float switches. The new more robust seals were successfully tested on USS *Rushmore* (LSD 47) and USS *O'Kane* (DDG 77), and will be installed throughout the Fleet.

Pollution Prevention Afloat

During 2000, NAVSEA's Pollution Prevention Afloat program's full-Fleet implementation began. Over 20 labor-saving commercial off-the-shelf opportunities that reduce shipboard labor, improve the safety and health of Sailors, and reduce hazardous materials were identified and tested. These include innovative aids in painting, hazardous material management, and solvent reduction. Equipment suites were tailored to match ship's missions, and then equipment to reduce manning, hazardous material procurement, and waste disposal costs. The Pollution Prevent Afloat equipment suites have been installed aboard 20 Fleet ships during 2000.

Sailor powder coats a part in the new Corrosion Control Facility aboard USS Rushmore *(LSD 47).*

Hazardous Materials Control and Management

The Shipboard Hazardous Material List Reduction program included representatives from NAVSEA as well as the Naval Inventory Control Point Mechanicsburg, the Naval Environmental Health Center, and the Naval Aviation Deport Jacksonville. The group reviewed the list of over 7,000 items, identified all hazardous materials with a documented shipboard requirement, and eliminated or prohibited items that were redundant or lacked an application or written requirement. As a result of this effort, the number of authorized hazardous materials required aboard ship was reduced by 50 percent to approximately 3,500 items.

Also, NAVSEA completed concept development for shipboard installation of Hazardous Material Minimization Centers (HAZMINCEN). NAVSEA Headquarters and NSWC Philadelphia conducted ship surveys to validate the status of the Fleet's establishment of HAZMINCENs and to determine if their establishment was feasible on certain ship classes. Ship Alteration packages were developed based on these recommendations.

Uniform National Discharge Standards

NAVSEA, as the lead for the Department of Defense, has worked with the Environmental Protection Agency (EPA) under the highly visible Uniform National Discharge Standards (UNDS) amendment to the Clean Water Act to identify shipboard liquid discharges that should be mitigated with Marine Pollution Control Devices (MPCDs). Under this continuing regulatory development program, NAVSEA and EPA are cooperatively setting performance standards for MPCDs (which can be equipment or management practices) to control 25 specific effluents from vessels of the Armed Forces. DoD will promulgate MPCD-implementing regulations in fiscal year 2005 that will provide ships and submarines with consistent liquid waste management targets throughout the United States, eliminating state-by-state regulation of discharges from Navy vessels. The selection, installation, and operation of MPCDs will take into account vessel class, type, age, size, and cost.

In 2000 NAVSEA completed sampling of the UNDS dis-

charges for support of environmental analysis required under the program. The sampling team gathered samples including bilge water, non-oily machinery wastewater, graywater, firemain, seawater cooling, gas turbine waterwash, compensated fuel ballast, and dirty ballast from various vessel classes. The resulting analyzed data are being used to assess the environmental impacts of the discharges to develop the discharge standards.

Additional Environmental Efforts

Battery Reclamation

Innovative teamwork turned a potential environmental liability into an asset. Faced with an inventory of unusable batteries containing tons of material that would have to be disposed of as hazardous waste, a NAVSEA team developed a process for reclaiming highly hazardous materials such as mercury and cadmium, and separating out highly valuable elements such as silver. The process grinds up the batteries and burns off combustible materials in a high-temperature furnace while capturing the volatile mercury through a vacuum distillation process.

The Battery Reclamation Facility at NUWC Division Keyport/Detachment Hawthorne, Nevada, takes large volumes of hazardous materials out of the waste stream while also avoiding substantial disposal costs. Over its lifetime, the facility is projected to reclaim 145 tons of mercury, avoiding over $4 million in disposal and landfill costs. The new process is better for the environment than the usual disposal of batteries in a hazardous waste landfill, and follows the new Department of Defense policy of environmentally aware demilitarization and recycling.

Bubble Curtains for Salmon

The National Marine Fisheries Service placed West Coast Chinook salmon on the "threatened species" list under the Endangered Species Act in 1999. Because the salmons' spawning path takes them close to the shoreline, they are at risk during Shipyard Dry Dock operations and often enter the dry docks when caissons are removed. Puget Sound Naval Shipyard has taken steps to protect the salmon, as well as other fish that may enter the dry docks, by installing "bubble curtains." Bubble curtains are made from pipes with many small holes in them. Air is forced through the pipes and out the holes, forming a curtain of bubbles which acts as a shield to keep young salmon and other fish from entering the dry docks. Studies have shown that the bubble curtains are extremely effective and have drastically reduced the number of fish trapped during caisson removals.

Potomac River Beach Clean-Up

April 2000 marked the 11th Annual NSWC Indian Head Potomac River Beach Clean-Up. Supported by the Chesapeake Bay Trust, 57 volunteers removed 62 bags of trash, four tires, a screen door, a Christmas tree stand, a television, a barge fender, a patio chair, 500 pounds of steel, and a county recycling bin. The Potomac Watershed Clean-up Program has organized beach clean-ups for the past several years with the goal being to clean up the watershed affecting the Chesapeake Bay. The Potomac River is the second largest tributary to the Chesapeake Bay. It, in turn, is fed by smaller streams. As trash is removed from local creeks and river shorelines, the water quality of the Bay is greatly improved.

Best Business Practices

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Focusing on core equities, and encouraging innovation and managed risk taking, NAVSEA strives to use the best processes to provide quality products and services at reduced costs.

Contracting Initiatives/Innovations

Navy Marine Corps Intranet. A critical initiative, NAVSEA is committed to common-sense commercial business processes and streamlined acquisition processes. A Navy contracting team, led by NAVSEA representatives, awarded the largest-ever government information technology contract to Electronic Data Systems (EDS) for the Navy Marine Corps Intranet (NMCI). It marks the beginning of unprecedented connectivity for the warfighting and business communities. Once fully implemented, it will be the largest single intranet in the world, and will provide secure, instant access to information and enhance the speed of quality decisions. Further, as a highly flexible integrated network, NMCI will facilitate the Navy's seamless transition to e-business in a technology-driven world.

The speed and success of the acquisition—less than 10 months after release of the solicitation—was primarily due to the team's use of acquisition processes such as oral proposals, due diligence, oral discussions, and network demonstrations. The solicitation was developed based on concentrated market research; similarly, the resulting contract is an amalgamation of the best commercial models for voice, video, and data services. It is structured to measure EDS against performance criteria, called "service level agreements" in areas such as customer satisfaction, availability of the network, and help desk response time. Similarly, EDS will be rewarded when it exceeds, and penalized for failure to meet, the service levels.

***Zumwalt* (DD 21) Class Destroyer.** Entering the Fleet late in this decade, DD 21 will usher in the Navy's newest class of destroyer, designed to meet the United States' post-Cold War defense needs. The Phase III-V requests for proposals (RFP) for continued development of the 21st Century destroyer DD 21 were released in September 2000. In 1998 the Navy awarded an Other Transaction Agreement to the DD 21 Alliance for two competing teams, the Blue and the Gold, to develop preliminary designs under a Total Ship Approach which serves as the basis for the Phase III-V proposals.

MK 48 Heavyweight Torpedo Intermediate Maintenance Activity. A first for the Navy's torpedo world, NAVSEA competitively awarded a fixed-price, performance-based contract to Raytheon Company in August 2000 to outsource the MK 48 Heavyweight Torpedo Intermediate Maintenance Activity (IMA) at Pearl Harbor, Hawaii. The IMA provides essential torpedo maintenance services and ready-for-issue weapons to the Submarine Fleet. This outsourcing will allow the Navy to more effectively utilize approximately 180 military billets and increase productivity by stabilizing the IMA workforce. The contract includes nine incentive periods to encourage torpedo reliability, availability, inventory maintenance, and response time.

Foreign Military Sales. Another example of innovative contracting in 2000 was the Foreign Military Sales procurement with Norway for the development and delivery of tactical software that will be integrated into an AEGIS-derived SPY-1F based weapon system. Lockheed Martin, Naval Electronics and Surveillance Systems, is providing the integrated weapon system for the Norwegian New Frigate Program as part of the team lead by Spanish shipbuilder Empresa Nacional Bazan. The tactical software contract is a cost-plus-fixed-fee contract that will provide operational software which will be integrated into the weapon system. The weapon system is being procured as a fixed-price direct commercial sale under an agreement between Lockheed Martin and Bazan. In an effort to maintain cost control and the integrity of the competitively derived cost-plus-fixed-fee contract, NAVSEA negotiated an incentive clause that specifically highlights aggressive management challenges and optimistic assumptions. At the completion of the contract, the contractors' actual cost performance in these specific areas will be compared to their proposed estimated cost. Should the contractor underrun the contract, they will be entitled to the entire incentive pool; should they overrun the contract by more than 16 percent, they will forfeit the entire incentive pool. The effect of the incentive is to give some meaning to a management challenge in a cost reimbursement contract.

New Techniques. In the Pacific Northwest, SUPSHIP Puget Sound has employed innovative ideas and new tech-

niques to improve performance, reduce costs, and maintain schedules. These have included the use of multi-ship/multi-option contracts with a cost plus incentive fee contract, and a paperless exchange of contract data.

Alteration Management Planning

NAVSEA receives messages and letters daily regarding the quality of alterations installed in all ship classes, with specific concern focused on the problems associated with inadequate planning or late addition of alterations to a deploying battle force. The objective of the Alteration Management Planning (AMP) program is to improve alteration management planning and installation to ensure that only fully mission-capable battle forces are deployed, and to improve the quality of service for the Sailors manning Navy ships. Analysis has shown that alteration planning and installation problems primarily exist due to a lack of coordination and planning within the various systems commands and the Fleet organizations responsible for ship modernization. AMP provides a common ground from which the various organizations can mutually leverage from active collaboration efforts.

AMP ensures that battle force centric processes are developed and utilized for scheduling and performing installation of alterations including the correct equipment, authorized drawings, and fully integrated logistic support. The program's success has been due to the development and utilization of common procedures across the system commands, and the providing of valuable, time-critical feedback information (i.e., metrics) to the Fleet modernization program and ship program manager community for process improvement. AMP also maintains a Master Listing of Alterations, a vital modernization tool which provides a snap-shot look at all alterations programmed for installation in battle force ships including relative installation maturity data as well as scheduling data.

Enterprise Resource Planning

NAVSEA is partnering with the Fleet to use an Enterprise Resource Planning (ERP) solution to standardize ship maintenance functions. The Navy Enterprise Maintenance Automated Information System (NEMAIS) program will standardize and streamline Navy business processes around a single core software system and common database.

In June 2000, the Navy selected IBM and its team of partnering companies to integrate core SAP/R3 software with several supplemental applications, and to interface this suite with any current "legacy" systems that the suite does not replace. This follows with the Navy's belief that proven commercial off-the-shelf software can reduce total cost and improve readiness and platform availability.

Currently, Fleet organizations, intermediate maintenance activities, and Naval Shipyard depots ("O," "I," and "D" levels, respectively) use a variety of processes, terminology, forms, and data fields to contract, plan, and execute their maintenance work. This makes synchronization of data difficult. ERP-enabled reforms will help to integrate O, I, and D level maintenance; improve resource management; update and upgrade information systems; improve maintenance planning and execution processes; and provide system users easier access to important information, thus enhancing their ability to do their jobs. The Navy Enterprise Team Ships, a Government/contractor management team assembled at the Naval Station Norfolk to manage the NEMAIS Program, has mobilized change management, business transformation, implementation, and information technology infrastructure teams to develop and implement the ERP solution throughout the Navy maintenance community.

Public-Private Partnership Initiatives

To provide an improved workforce surge capability, Portsmouth Naval Shipyard entered into a memorandum of agreement with General Dynamics/Electric Boat Corporation, Groton, Connecticut, to pursue mutually beneficial activities for

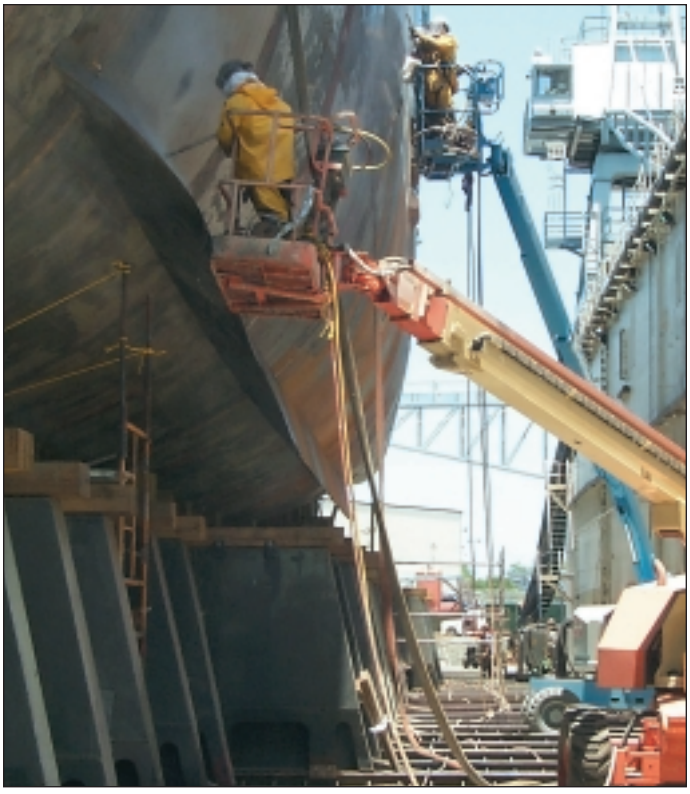
The only thick-steel laser cutting machine used in a shipyard, and the largest laser used in manufacturing anywhere in the world, is owned by Bender Shipbuilding and Repair Co. in Mobile, Alabama. Bender is leading one NSRP ASE-funded project in collaboration with Caterpillar to leverage existing laser research, and one with IPSCO Steel to define the best steel qualities within the parameters allowed for shipbuilding. Bender is developing and testing advanced structural joining methods based on innovations in laser cutting, precision forming technology, and tab and slot technology.

submarine overhaul business practices in the Northeast region. This includes workload analysis, use of shipyard advanced industrial management products, work certification, and best industrial processes. Electric Boat employees are currently working on overhauls at Portsmouth Naval Shipyard, and on Selected Restricted Availabilities (SRAs) being performed at Submarine Base, New London, Connecticut. Electric Boat has also been involved with Norfolk Naval Shipyard in the performance of an SRA on a Norfolk-based submarine. Lessons learned from these availabilities will be directly applicable to the NAVSEA submarine factory initiative.

National Shipbuilding Research Program Advanced Shipbuilding Enterprise

The National Shipbuilding Research Program (NSRP) Advanced Shipbuilding Enterprise (ASE), an industry-led program cost-shared with the Navy, continues its focus on improving shipbuilding processes and technologies. The goal of this collaborative effort, which began in 1998, is to establish the U.S. industry's international commercial competitiveness and to reduce the cost of warships to the Navy.

During 2000, NSRP ASE began nine new collaborative projects chosen by the industry after a rigorous and competitive selection process. Among these projects is the Shipbuilding Supply Chain Virtual Enterprise (often referred to as "SPARS"), which teams shipyards with IBM to implement industry-standardized web-based business-to-business vendor and supplier processes. The Integrated Shipbuilding Environment, another major project, integrates shipbuilding information technology systems to perform design/build activities online. In a third key project, Laser Cutting and Joining led by Bender Shipbuilding, Bender is establishing laser precision steel cutting technology that will lead to significant savings in total steel and outfit cost and cycle time.



Ultra High-Pressure Water Blasting. Atlantic Marine is teaming with Todd Pacific Shipyards on an NSRP ASE-funded research project to improve the efficiency of the water blast process.

The Navy gains an important benefit through NSRP ASE's aggressive technology transfer. NSRP ASE capitalizes on a group of nine ship production panels to form an important communication channel within the shipbuilding industry. In 2000, NSRP ASE assisted in the development of shipbuilding state-of-the-art and benchmarking reports, comparing U.S. with European and Asian shipbuilding. NSRP ASE has several ongoing efforts in the development of shipbuilding standards in materials, design, information technology, procurement terms and conditions, and electronic commerce. All research results are shared openly among the industry, academia, and government organizations through panel meetings, workshops, symposia, conferences, and the NSRP ASE website.

Naval Shipyard Performance Management Applications

In addition to providing technical oversight to the Naval Shipyard Performance Management applications, the Naval Sea Logistics Center delivered a number of high visibility software support applications intended to help the Naval shipyard community deliver its availabilities with higher quality and lower costs.

The Quality Performance System (QPS) client server application was created to provide automated performance trends and reports on quality related categories. QPS was installed on production servers at Portsmouth, Norfolk, Puget Sound, and Pearl Harbor Naval Shipyards during the summer of 2000.

Corporate Lessons Learned (CLL) was installed on a production server at Norfolk Naval Shipyard during the fall of 2000. CLL is an application designed to allow the storage and retrieval of lessons learned in the performance of past work. Each lesson learned is categorized according to a number of factors, and can be used for both nuclear and non-nuclear work.

Innovative Initiatives for the Fleet

NAVSEA embraced Acquisition Reform (AR) as the way of doing Government business in several significant projects in 2000, realizing benefits to the Fleet that have been several years in preparation.

One aspect of AR is to leverage commercial designs where possible. Along these lines, NAVSEA put a Government procurement contract in place for commercially available life rafts for Fleet ships that saves procurement dollars, topside weight, and maintenance dollars. Comparing Navy procedures to commercial procedures for possible savings led to an initiative that decreases periodicity on boat davit weight testing based on inspection results.

By looking at established procedures from a different perspective, the groundwork was laid for making major changes to

underway replenishment, automating many of the functions currently conducted by Sailors and providing more of the work from the delivery ship. As a result of NAVSEA technical management and platform system program oversight, upgrades and improvements are being brought to the Fleet in a matter of months.

Replacement of Silicon-Loaded, Beryllium Oxide Ceramics

Early in 1999, the sole U.S. supplier of silicon-loaded, beryllium oxide (BeO/SiC) ceramics ceased production, thus impacting microwave tube production and repair across the Department of Defense. Working with their counterparts in private industry, NAVSEA's NSWC Crane scientists and engineers developed and implemented a three-phase plan to reduce production risk to the microwave tube manufacturers and ensure the long-term viability of this critical technology.

Initially, residual material from the manufacturer was used to meet short-term requirements. This was followed with the development of an alternate source of equivalent material to meet near-term production requirements. Finally, since BeO/SiC dust is a known health hazard that has received national media attention, NSWC Crane teamed with the Office of Naval Research to develop a long-term replacement material.

Without NAVSEA's leadership efforts and technical expertise, the impact of this critical compound's shortage could have been felt as early as July 2000. Instead, the use of residual and equivalent material has extended the existing inventory 2-3 years, while the development of a replacement material is expected to yield results in approximately 18-24 months.

Business Process Interface Link

The Business Process Interface Link (BPIL), a corporate team composed of field activities and headquarters personnel, supported NAVSEA's business process strategic goal in 2000. Along with the SEA 09B Corporate Planning team, the BPIL co-sponsored a NAVSEA corporate planning conference to improve information sharing on business process improvement as well as business planning and Balanced Scorecard. It also organized two corporate-wide video teleconferences featuring two of NAVSEA's most successful efforts, NSWC Crane's Business and Process Reengineering program, and NUWC Newport's Intramart Best Practice. Also, BPIL significantly improved its own website which is designed to share best practices, process improvements, and other related topics throughout NAVSEA. Available both on NAVSEA's intranet and to Navy military users via the internet, this effort was recognized at the Navy's Knowledge Fair 2000 in Norfolk, Virginia, for its corporate value, quality, and tremendous improvement. The site includes an interactive database that provides a listing of best practices as identified by the NAVSEA Inspector General Command Performance Inspections, as well as successful business initiatives being implemented throughout the NAVSEA corporation.

Ex-USS Wisconsin *en route to the Nauticus Museum in Norfolk, Virginia.*

COMMUNITY

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STEP Forum

NAVSEA's Naval Warfare Assessment Station in Corona, California, participated in the first annual Science and Technology Education Partnership (STEP) forum focusing on improving science, math, and technical education in primary and secondary schools in California, and focusing on helping prepare students for the high-technology workplace of the future. NAVSEA Corona coordinated the science exposition portion of the STEP ONE Forum held in Riverside, California, in November 2000.

The one-day event was designed to raise student, parental, industry, and community awareness of the skills gap between K-12 students and the labor needs of the high-technology sector. Joined by 22 companies, government organizations, and universities, NAVSEA Corona's exhibit featured an infrared imaging camera with color print out, and a wearable computer with wireless local area network (LAN).

Firefighter Training

In support of the Department of Defense Firefighter Certification which became mandatory for firefighters in June 2000, NSWC Crane, in conjunction with the Indiana Fire Instructors Association, conducted firefighter training in the spring and summer of 2000. The classes were certified by the International Fire Service Accreditation Congress, Oklahoma State University. Participation in the classes was extended to firefighters in the State of Indiana as well as throughout the Department of Defense. Classes generated a high degree of interest; enrollees hailed from Georgia, Texas, North Carolina, Ohio, Kentucky, Italy, and Japan, as well as Indiana. NSWC Crane's "Firefighters Academy" is on the road to success for both the local community and the Department of Defense.

Local Science Fairs

For over 30 years, NSWC Indian Head employees have participated as judges for the Charles County, Maryland, Science Fair. Throughout February and March 2000, over 130 NSWC Indian Head employees donated their time judging entrees at individual county schools as well as at the countywide competition. In addition to judging, NSWC Indian Head presented special awards recognizing top projects in applied science, environmental science, engineering, and physics.

In April 2000, NSWC Crane awarded $3,000 in cash prizes to the winners of its 17th Annual Science Fair. Twenty-six schools participated with a total of 223 science projects. The Federal Managers' Association sponsored the fair; NSWC Crane employees served as judges. Awards were provided by NSWC Crane employee organizations, contractors, and through private donations.

Annual "Buy Indiana" Business Fair

The 4th Annual "Buy Indiana" Business Fair was held in October 2000 in French Lick, Indiana. This year's event was sponsored by NSWC Crane along with the U.S. Small Business Administration, Indianapolis, and the Government Marketing Assistance Group, and in conjunction with the Crane Regional Economic Development Organization. Over 160 businesses representing several Indiana counties participated. The fair included a panel discussion by state and federal representatives, and various workshops for small business personnel.

The fair was developed to increase awareness of contracting opportunities at NSWC Crane for Indiana companies. NSWC Crane spent over $19 million in micro purchases last year, with most orders averaging approximately $800. The "Buy Indiana" initiative keeps a substantial amount of micro purchase money in the state economy.

Pre-Engineering Partnership Program

NAVSEA's NSWC Port Hueneme and five local high schools joined forces to offer selected students the opportunity to participate in a pre-engineering program. The program, now in its third year, provides 10 high school students 12 weeks of hands-on learning about the practical workings of math and science and engineering principles. The weekly sessions are held at selected locations on the base in a classroom or laboratory setting, where students are given the opportunity to solve engineering problems derived from current, real-world situations. Command engineers teach the classes in their areas of expertise, including the Aegis combat system, the vertical launching system, missile test procedures, and underway replenishment. Students are encouraged to return to the Command after they obtain their engineering degrees.

Schoolchildren Learn about Navy Ships

When ships visit NAVSEA's NSWC Port Hueneme, the crews experience more than technical assistance with their ship's combat systems. They get the opportunity to introduce eager schoolchildren to life aboard a Navy ship. In 2000, more than 1,600 local schoolchildren boarded visiting ships at the Port Hueneme dock.

Local schools can coordinate the private ship tours through NSWC Port Hueneme's public affairs office. Sailors take the schoolchildren through the ship describing various components and answering pondering questions such as, "What does a frigate do?" "Are you going to fire a missile today?" "What does a captain of a ship do?" "Where do the Sailors sleep?" Through this hands-on experience, the children gain valuable insight into the various jobs performed, the duties of Sailors, and what the Navy does. The favorite thing for young students to learn? How to salute.

Earth Day

Since Earth Day 1995, SUBMEPP has used proceeds from its recycling efforts to hold an annual seedling giveaway. In celebration of Earth Day 2000, SUBMEPP provided more than 200 crabapple seedlings, a New England favorite from the New Hampshire State Nursery, for home and community plantings.

Cutthroat Christening

Cutthroat (LSV 2), the world's largest autonomous, unmanned submarine, was christened in a ceremony at NSWC Carderock's Acoustic Research Detachment in Bayview, Idaho, in November 2000. Submarine design experts will use the large scale model of the future *Virginia* (SSN *774*) Class attack submarine, which measures 110 feet in length and 10 feet in diameter, for testing advanced submarine technologies. *Cutthroat's* sponsors, local Athol Elementary School students who chose its name, signed the boat's hull.

National Night Out

Over 600 people participated in 2000's National Night Out (NNO) celebration in August, the second annual joint collaboration between NSWC Indian Head and the Town of Indian Head, Maryland, under the "US—United in Spirit" partnership. NNO is an effective, inexpensive, and enjoyable program to promote neighborhood spirit and police-community partnerships in the fight for a safer nation. The evening was a free event with food, entertainment, children's activities, finger printing, a visit from McGruff the crime prevention hound, and much crime prevention and community information.

Naval Undersea Museum "E" Day

National Engineers Discover "E" Day was celebrated at the Naval Undersea Museum at NUWC Keyport in February 2000. Over 700 children along with their parents and grandparents participated. The Museum established seven different stations where NUWC Keyport engineers and museum volunteers guided the children as they built electromagnets, constructed geodesic domes, experimented with buoyancy, and tried other hands-on activities. The activities emphasized children doing science experiments and activities themselves rather than just watching someone else.

Bicentennial Celebration

Portsmouth Naval Shipyard marked a momentous event in its rich history and proud service to the Nation by celebrating its 200th anniversary in June 2000. The bicentennial celebration extended over a week, with events scheduled at the Shipyard and the neighboring communities of Portsmouth, New Hampshire, and Kittery, Maine.

The Shipyard's anniversary open house offered nearly 100,000 visitors an opportunity to appreciate the Shipyard's importance to the region's economic, cultural, and community life, as well as to reacquaint the community with the Yard's current mission and the service it has provided to the country over the past 200 years. USS *Maine* (SSBN 741) visited the Shipyard during the celebration; officers and crew opened the ship for touring, hosting over 10,000 visitors. The officers and crew of the U.S. Coast Guard Cutter *Reliance*, which is homeported at the Yard, was also open for touring. The week's festivities included entertainment provided by various bands and singing/dancing groups; various national, state, local, and Navy officials also participated in the scheduled events. The culmination of the week's activities was the dedication of Shipyard Workers Memorial Park, a new park on the Yard honoring Shipyard employees, past and present, for their contributions and achievements extending over 200 years.

Hospital Halloween

Halloween is an exciting time for most children, but children confined to a hospital ward need a little help with trick-or-treating. Fourteen members of the Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility community visited Kapiolani and Shriners Children's Hospitals to do just that. They delivered Halloween toys and candy donated from various organizations in Pearl Harbor to the young patients.

Good Neighbor Project

NAVSEA Headquarters' Good Neighbor Project 2000 made a difference in the lives of many elementary students at an elementary school in the Washington, D.C., area near NAVSEA's new headquarters location at the Washington Navy Yard. NAVSEA collected over 1,100 winter clothing items and 2,300 children's books and notebooks.

USS Maine *(SSBN 741) revisits Portsmouth Naval Shipyard. The ballistic missile submarine was commissioned at Portsmouth in 1995 and returned home during the Shipyard's bicentennial celebration in June 2000.*

Awards And Patents

NAVSEA
NAVAL SEA SYSTEMS COMMAND
Keeping America's Navy #1 in the World

Awards

The year 2000 was another award-winning year for NAVSEA and its divisions, activities, and personnel. Technologically superior facilities in combination with a dedicated and talented workforce contributed to this success. The following is a brief look at how NAVSEA was recognized for its leadership, expertise, and efforts throughout the year.

Hammer Awards

Since the program's inception in 1993, Hammer Awards have been presented to individuals, teams, and organizations that have simplified and streamlined governmental processes, thus significantly contributing to building organizations that work better and cost less. To date, the NAVSEA team has been awarded 46 Hammer Awards. Two were awarded in 2000.

The Naval Systems Data Support Activity Modular Specification Team, NSWC, Port Hueneme Division, for developing and implementing an interactive, paperless, web-based database of technical requirements which reduces the time it takes to obtain technical information from 15 days to eight minutes, thus saving the Navy money.

The NUWC Division Keyport Mine Warfare Maintenance Migration Team, with its Fleet and contractor partners, for their innovations and improvements in mine warfare. The team streamlined the repair processes used to support minehunting sonar systems, reducing repair time from months to weeks and decreasing operational support costs for critical assets. The minehunting sonar system is a suite of equipment that is essential to the mission of the Navy's Minehunter and Mine Countermeasures Ships.

Environmental and Safety Awards

White House Closing-The-Circle Award to the *Virginia* Class Submarine Environmental Management Team in recognition of achievement in Federal acquisition, recycling, and waste pollution prevention.

White House Closing-The-Circle Award to NUWC Newport for development and implementation of innovative and cost-effective methods of recycling and waste pollution prevention.

White House Closing-The-Circle Award to Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility for excellence in making significant contributions to, or impact on, the environmental community.

Secretary of Defense Pollution Prevention Weapon System Acquisition Team Award/Honorable Mention to the *Virginia* Class Submarine Program.

Secretary of Defense Environmental Security Award (Honorable Mention) for Environmental Quality—Industrial Installation to Puget Sound Naval Shipyard.

Secretary of Defense Environmental Security Award (Honorable Mention) for Pollution Prevention—Weapon System Acquisition Team to the *Virginia* Class Submarine Program.

Secretary of Defense Environmental Security Award (Honorable Mention) for Recycling—Industrial Installation to NSWC Crane.

Secretary of the Navy Pollution Prevention Weapon System Acquisition Team Award to the *Virginia* Class Submarine Program.

Secretary of the Navy Award for Achievement in Safety Ashore—Large Industrial Activity to Puget Sound Naval Shipyard.

Secretary of the Navy Award for Achievement in Safety Ashore (Runner-Up)—Large Industrial Activity to Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility.

Secretary of the Navy Environmental Award for Environmental Quality—Industrial Installation to Puget Sound Naval Shipyard.

Secretary of the Navy Environmental Award (Runner-Up) for Environmental Quality—Industrial Installation to Norfolk Naval Shipyard.

Secretary of the Navy Environmental Award for Pollution Prevention—Weapon System Acquisition Team to the *Virginia* Class Submarine Program.

Secretary of the Navy Environmental Award (Runner-Up) for Pollution Prevention—Industrial Installation to Norfolk Naval Shipyard.

Secretary of the Navy Environmental Award for Recycling—Industrial Installation to NSWC Crane.

Secretary of the Navy Energy Award—Small Activity Category for outstanding energy conservation and energy management to AUTEC Detachment, NUWC Newport.

Secretary of the Navy Achievement in Safety Ashore Award / Runner-Up Honors to Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility.

Secretary of the Navy Environmental Awards / Environmental Quality—Industrial Installation to Puget Sound Naval Shipyard.

Secretary of the Navy/Chief of Naval Operations Activity Award for Achievement in Safety Ashore—Non-Industrial Installation to NUWC Newport for providing a work environment that enhances the productivity, safety, and quality of life of its entire workforce.

Secretary of the Navy/Chief of Naval Operations Environmental Award: Recycling—Non-Industrial Installation to NUWC Newport for instituting a top-quality waste management program that encompasses solid waste disposal, recycling, and the purchase and use of recycled products.

Chief of Naval Operations Pollution Prevention Weapon System Acquisition Team Award to the *Virginia* Class Submarine Program.

Chief of Naval Operations Award for Achievement in Safety & Occupational Health to Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility.

Chief of Naval Operations Award for Achievement in Safety & Occupational Health to Puget Sound Naval Shipyard.

Chief of Naval Operations Award for Achievement in Safety & Occupational Health to SUPSHIP Newport News.

Chief of Naval Operations Environmental Award for Natural Resources Conservation—Small Installation to NSWC Indian Head.

Chief of Naval Operations Environmental Award for Environmental Quality—Industrial Installation to Puget Sound Naval Shipyard.

Chief of Naval Operations Environmental Award for Environmental Quality—Industrial Installation to Norfolk Naval Shipyard.

Chief of Naval Operations Environmental Award for Environmental Quality—Industrial Installation to Portsmouth Naval Shipyard.

Chief of Naval Operations Environmental Award for Environmental Quality—Individual/Team to NAVSEA's Ship Environmental Protection Process Action Team.

Chief of Naval Operations Environmental Award for Pollution Prevention—Industrial Installation to Puget Sound Naval Shipyard.

Chief of Naval Operations Environmental Award for Pollution Prevention—Industrial Installation to Norfolk Naval Shipyard.

Chief of Naval Operations Environmental Award for Pollution Prevention—Weapons System Acquisition Team to *Arleigh Burke* (DDG 51) Class Destroyer Program.

Chief of Naval Operations Environmental Award for Pollution Prevention—Weapons System Acquisition Team to *Virginia* Class Submarine Program.

Chief of Naval Operations Environmental Award for Recycling—Industrial Installation to NSWC Crane.

Chief of Naval Operations Environmental Award for Environmental Cleanup—Individual/Team to the Environmental Cleanup Team, NSWC Crane.

Chief of Naval Operations Natural Resources Conservation for an Industrial Installation Award to NSWC Indian Head for its accomplishments in the areas of land use and forest management, conservation education, and community relations.

Chief of Naval Operations Environmental Awards / Environmental Quality—Industrial Installation and **Pollution Prevention—Industrial Installation** to Puget Sound Naval Shipyard.

Office of Naval Research Cheapskate Prize for Affordability to NSWC Port Hueneme (co-recipient) for the development of an innovative technology that helps the Navy remove carcinogenic asbestos from the Fleet while enabling smoother, faster, and safer underway replenishment at sea.

Office of Naval Research Cheapskate Prize for Affordability to the Hydromechanics Directorate Team, NSWC Carderock, for the Stern Flap Program for *Spruance* (DD 963) Class destroyers and *Ticonderoga* (CG 47) Class cruisers, and their leadership and technical innovation in the pursuit of ship design modifications which provide breakthroughs in ship energy efficiency.

United States Coast Guard William M. Benkert Award / First Runner-Up—Large Business, Facility Operations to Puget Sound Naval Shipyard for excellence in marine environmental protection.

Department of Energy's Renewable Energy Award to NSWC Dahlgren for a series of energy-savings measures, including a solar lighting project for the Weapons Systems Department Headquarters parking lot.

Department of Energy 2000 Federal Energy and Water Management Award to AUTEC Detachment, NUWC Newport, which recognizes outstanding contributions toward meeting Department of Energy goals to reduce energy and water consumption and to promote renewable energy.

Strategic Environmental Research and Development Program's Pollution Prevention Project of the Year Award to the Low Volatile Organic Compound Chemical Agent Resistant Coating Project, which includes personnel from NSWC Carderock/Philadelphia, as well as from the Army and Air Force. The new coating will standardize chemical agent resistant coating among the three services.

State of Indiana Pollution Prevention Award to a NSWC Crane team for substituting safer dyes and dye mixes for organic dyes in munitions without changing performance, and at the same time alleviating irreversible and incapacitating health hazards to industrial personnel and the environment.

State of Indiana Governor's Award for Excellence in Recycling to NSWC Crane for recycling nearly 20,000 tons of material.

State of Indiana Governor's Award for Pollution Prevention to NSWC Crane for substituting safer dyes in munitions to replace organic dyes in munitions, the use of a fuel cell as an alternative energy source at Crane, and Crane's participation as a team member of "Partners for P2," a partnership of private industry, the Indiana Department of Environmental Management, and NSWC Crane.

Maryland Department of Natural Resources Forest Service and the Maryland Community Forest Council's Maryland Plant Community Award to NSWC Indian Head for its active involvement in tree planting.

National Arbor Day Foundation, in cooperation with the National Association of State Foresters and the USDA Forest Service, Tree City USA Award to NSWC Indian Head for its ongoing urban forestry efforts and tree-care program.

Miscellaneous Department of Defense, Department of the Navy, State, and Other Awards

Department of Defense Value Engineering Achievement Award/Navy Installation Award to NSWC Crane for collective efforts in three affordable readiness initiatives in the AN/ALQ-99 Electronic Countermeasures System.

Department of Defense Value Engineering Achievement Award/Special Teaming Award to NSWC Crane for efforts by Crane and three battery manufacturers in the development of new battery and vent cap designs that provide improved safety, reliability, and performance.

Department of Defense Single Process Initiative Recognition Award to the Systems Acquisition Program, Program Executive Office for Theater Surface Combatants.

Office of the Secretary of Defense Standardization Program Outstanding Performance Award to the Detection Processing and Navigation Systems Program Management Office UYQ-70 Program Team for outstanding performance in the implementation of the Defense Standardization Program.

Defense Modeling and Simulation Office Award for Outstanding Achievement to the Collateral Damage Estimation Tool team comprised of members from NSWC Dahlgren's Joint Warfare Applications Department and the Joint Warfare Analysis Center.

Secretary of the Navy Meritorious Unit Commendation to the Navy Experimental Diving Unit for meritorious service from January 1997 to December 1999, consistently demonstrating expert technical knowledge and expertise in the manned biomedical research, development, testing, and evaluation of diving, hyperbaric, and other life support systems and procedures to support the operational requirements of the U.S. Armed Forces.

Assistant Secretary of the Navy for Research, Development and Acquisition Award for Excellence in Acquisition Reform to the Area Air Defense Commander (AADC) Capability Program Office, Program Executive Office for Theater Surface Combatants, for furthering initial acquisition reform efforts to a level which provides a model of program execution very close to the new Department of Defense 5000.1 and 5000.2 policy initiatives.

Chief of Naval Operations Admiral Stan R. Arthur Logistics Team of the Year Award to the Navy Integrated Call Center Team for developing a responsive, web-based, single point of entry for all Fleet requests for assistance or information.

Office of Naval Research Dr. Arthur E. Bisson Award for Naval Technology Achievement to NAVSEA's Advanced Enclosed Mast/Sensor (AEM/S) System Advanced Technology Demonstration Team for successfully demonstrating composite, signature, and electromagnetic engineering technology in an integrated mast concept on USS *Arthur W. Radford* (DD 968), making possible radical improvements in the topside design of all future Navy surface ships.

President's Quality Award—Finalist to NUWC Keyport in recognition of making Government work better and cost less, and for providing quality services.

President's Quality Award—Finalist to Norfolk Naval Shipyard in recognition of making Government work better and cost less, and for providing quality services.

California Quality Award—Bronze Level to NAVSEA Corona for its commitment to high performance through pursuit of balanced scorecard leadership and management practices consistent with the Malcolm Baldridge Quality Award Criteria.

Margaret Chase Smith Maine State Quality Award Level 1 to SUBMEPP in recognition of advances it has made to improve the quality and competitiveness of its products, services, and key business processes.

John N. Sturdivant National Partnership Award to NSWC Crane and the American Federation of Government Employees Local 1415 for their labor/management partnership, and its cooperative approach to day-to-day problem solving and implementation of the business and process reengineering initiative.

Revolution in Business Affairs Beacon Award to NAVSEA's Capital Investment for Labor Program for significant business reforms in the pursuit of the Navy's business vision and goals.

Association of Scientists and Engineers Team Award to NAVSEA's Capital Investment for Labor personnel for significant technical and professional contributions to U.S. Navy programs and mission priorities.

Best Manufacturing Practices Center of Excellence Recognition to Naval Sea Logistics Center Portsmouth for nine "Best Practices in Industry, Government, and Academia."

Balanced Scorecard for Government Award to NUWC Newport for its outstanding performance in applying best practices in the implementation and use of the Balanced Scorecard in a Government environment.

Combined Federal Campaign Bronze Award to NUWC Keyport/Hawaii Detachment in recognition of its excellent achievement in the 2000 Combined Federal Campaign Drive.

Franklin Covey Organization of Excellence Award to Norfolk Naval Shipyard for sustaining a strong culture while striving to achieve long-term performance results.

Alliance for World Class Education and the Jacksonville, Florida, Chamber of Commerce Hall of Fame Induction to SUPSHIP Jacksonville for bringing excellence to the Duval County Public Schools through school partnering initiatives.

Historical Diving Society of England's Nautick Award to the Naval Undersea Museum, NUWC Keyport.

***Government Computer News'* Agency Award for Innovation in Information Technology** to the Program Executive Office for Theater Surface Combatants for its work on the Electronic Trial Card program.

Patents

Naval Surface Warfare Center

Carderock Division

Combined Wedge-Flap for Improved Ship Powering. U.S. Patent No. 6038995. Inventors: Gabor Karafiath, Dominic S. Cusanelli.

Shape Memory Actuator System. U.S. Patent No. 6041728. Inventors: David Goldstein, Thang Dinh Nguyen.

Elastromeric Composite Bumper System and Method for Absorbing High Energy Impact. U.S. Patent No. 6053664. Inventors: Roger M. Crane, Kathleen A. Corona-Bittick, Donald James Dorr.

Foil Assisted Marine Towing. U.S. Patent No. 6055924. Inventors: Jason T. Marshall, John M. Almeter, Denis G. Bushey.

Ventilated Outboard Motor-Mounted Pumpjet Assembly. U.S. Patent No. 6059618. Inventors: John G. Purnell, Alan J. Becnel.

Boron Carbide/Silicon Carbide Ceramics. U.S. Patent No. 6069101. Inventors: Inna G. Tamy, James A. Zaykoski.

System for Simulation of Underwater Explosion Pressure Fields. U.S. Patent No. 6075753. Inventors: Joseph A. Clark, Jane A. Young, Joel B. Gaspin, Paul M. Moore.

Fuel Storing Water Ballast Tank Internally Structured for Reducing Retention of Water and Overboard Discharge of Fuel. U.S. Patent No. 6076480. Inventors: Peter A. Chang III, Brian Hill, Dan Bruchman, Ray Schmitt, Carl Schmid, Scott Jackson.

Embedded Wear Sensor. U.S. Patent No. 6080982. Inventor: Edward Isaac Cohen.

Method of Centrifugally Casting Reinforced Composite Articles. U.S. Patent No. 6082436. Inventors: Amarnath P. Divecha, Subhash D. Karmarkar, Philip Hesse, William J. Bruchey.

Component Deployment Means for Ice Penetrating Acoustics Communication Relay System. U.S. Patent No. 6097668. Inventor: Wayne J. Hopkins.

Rudder Tab for Suppression of Tip Vortex Cavitation. U.S. Patent No. 6101963. Inventors: Young T. Shen, Scott Gowing.

Venturi Muffler Having Plural Nozzles. U.S. Patent No. 6105716. Inventors: Clyde A. Morehead, John W. Henry, IV.

Fabrication of Tile Reinforced Composite Armor Casting. U.S. Patent No. 6116328. Inventors: Subhash D. Karmarkar, Amarnat P. Divecha, William J. Bruchey, Gerald Bulmash, James M. Kerr, William A. Ferrando.

Multiassay Method for Determining the Concentrations of Antigens and Interferants. U.S. Patent No. 6127130. Inventor: Robert A. Brizzolara.

Synthesis of Metal Matrix Composite. U.S. Patent No. 6129134. Inventor: Amarnath P. Divecha.

Fabrication of Metal-Matrix Compositions. U.S. Patent No. 6129135. Inventors: Amarnath P. Divecha, Subshash D. Karmarkar, William A. May, James M. Kerr, William A. Ferrando, Scott M. Hoover.

Shipboard Paint Dispensing System. U.S. Patent No. 6138724. Inventors: Rimi O. Rivera, James M. McDonnel, Drew F. Jackson, Stephan J. Verosto, Jr., David J. Barnes, Michael R. Murnane.

Prestress Imposing Treatment of Magnetostrictive Material. U.S. Patent No. 6139648. Inventors: Marilyn Wun-Fogle, James B. Restorff, Arthur E. Clark.

Infrared Transparent Radar Antenna. U.S. Patent No. 6150974. Inventors: Toshio Tasaka, Harold R. Riedl, James B. Restorff.

Dahlgren Division

Computer Readable Software and Computer Implemented Method for Performing and Integrated Sonar Simulation. U.S. Patent No. 6096085. Inventor: Gary Sammelman.

Liquid Insulated Garment for Cold Water Diving. U.S. Patent No. 5960469. Inventors: Marshall Nuckols, Ruchard Ramsey, Billy Courson, James Zoulias.

Line Charge Deployment Apparatus. U.S. Patent No. 5960732. Inventor: Ronald Peterson.

Breathing Apparatus Having Electrical Power Supply Arrangement with Turbine-Generator Assembly. U.S. Patent No. 5969429. Inventors: Joseph Rudolph, Robert Hughes, Kenneth Price.

Magneto-Inductive Seismic Fence. U.S. Patent No. 5969608. Inventors: John Sojdehei, Felipe Garcia, Robert Woodall.

Surface Launched Sonobuoy. U.S. Patent No. 5973994. Inventor: Robert Woodall.

Lidar Detection Using Shadow Enhancement. U.S. Patent No. 5989087. Inventors: Brett Cordes, Jack Lloyd.

Reusable Gas Powered Hand Grenade. U.S. Patent No. 5996503. Inventors: Robert Woodall, Felipe Garcia.

Diver's Face Mask Having Aspheric Afocal Lens Systems Providing Unit Magnification for Use as a Window between Air and Water. U.S. Patent No. 5997138. Inventor: Harold Suiter.

Long Life Coaxial Sparker for Underwater Sound Source. U.S. Patent No. 6018502. Inventor: Leolan Fry.

Surf Zone Mine Clearance. U.S. Patent No. 6032567. Inventors: Steve Jones, James Rumbough.

Flotation Flyaway. U.S. Patent No. 6037031. Inventors: Steve Jones, James Rumbough.

Integrated and Automated Control of a Cranes' Rider Block Tagline System. U.S. Patent No. 6039193. Inventors: Steve Naud, Max Weber, Lei Lucero, Dexter J. Bird, Martin Fink.

Afocal Water-Air Lens with Greatly Reduced Lateral Color Aberration. U.S. Patent No. 6039445. Inventor: Harold Suiter.

Fractal Features Used with Nearest Neighbor Clustering for Identifying Clutter in Sonar Images. U.S. Patent No. 6052485. Inventors: Susan R. Nelson, Susan Tuovila.

Magneto-Inductive Submarine Communications System and Buoy. U.S. Patent No. 6058071. Inventor: Robert Woodall.

Force Limiting Tapered Shear Shop. U.S. Patent No. 6065186. Inventor: Richard Jermyn.

Lever Device with Support and Latch. U.S. Patent No. 6065896. Inventor: Richard Jermyn.

Air-Cushion and Accurate Mine Laying and Mapping System. U.S. Patent No. 6082266. Inventors: John Auzins, John Horton, David Vickers, William Jones.

Standoff Delivered Sonobuoy. U.S. Patent No. 6082675. Inventors: Robert Woodall, Felipe Garcia.

Low Watch Circle Buoy System. U.S. Patent No. 6093069. Inventor: Stephen Schelfhout.

Automated Image Enhancement for Laser Line Scan Data. U.S. Patent No. 6097849. Inventor: Andrew Nevins.

High Noise Communication System. U.S. Patent No. 6104816. Inventors: Edward F. Downs, Kevin Venturella.

Line Contrast Difference Between Effect Correction for Laser Line Scan Data. U.S. Patent No. 6108454. Inventors: Andrew J. Nevis, Gerald Dobreck.

Background Equalization for Laser Line Scan Data. U.S. Patent No. 6108457. Inventor: Andrew J. Nevis.

Magneto-Inductively Controlled Limpet. U.S. Patent No. 6112668. Inventors: Robert Woodall, Felipe Garcia, John Sojdehei.

Passive Thermal Capacitor for Cold Water Diving Garments. U.S. Patent No. 6120530. Inventors: Marshall Nuckols, Robert Hughes, Cara Grupe, Steven Fitzgibbon.

Multi-Stage System for Microbubble Production. U.S. Patent No. 5961895. Inventor: Matthew Sanford.

Fiber Optic Furcation Unit. U.S. Patent No. 5970195. Inventor: Gair Brown.

Platform Independent Computer Interface Software Responsive to Scripted Commands. U.S. Patent No. 5978834. Inventors: Adam Simonoff, Larry A Fontenot, Robert L. Taft, Brian McClintock.

Copper Crusher Guage Holder. U.S. Patent No. 5987962. Inventors: Raymond Bowen, Eugene Bowie.

Spinning Focal Plane Array Camera Particularly Suited for Real Time Pattern Recognition. U.S. Patent No. 5990829. Inventor: Joseph Garcia.

Method of Suppluing Multiple Loads from Multiple Sources Over an Interconnected Network of Defined Paths. U.S. Patent No. 5991815. Inventors: Keith Prater, Alan Shrimp.

Booster Circuit for Foldback Current Limited Power Supplies. U.S. Patent No. 5994884. Inventor: Robert Paterno.

Leak Test Adapter System. U.S. Patent No. 5996401 Inventor: Keith Lewis.

Method and Apparatus for Infrared Detection of a Moving Target in the Presence of Solar Clutter. U.S. Patent No. 5999212 Inventor: Michael Wardlaw.

Computer System Providing Platform Independent Universal Client Device. U.S. Patent No. 6005568. Inventors: Adam Simonoff, Larry Fontenot, Robert Taft, Brian McLintock.

Shoulder Fired Multi-Purpose Assault Weapon. U.S. Patent No. 6014923. Inventors: Michael Canady, Fred Watson.

Digital Data Apparatus for Transferring Data Between NTDS and BUS Topology Data Buses. U.S. Patent No. 6023752. Inventor: William Huttle.

Insensitive Warhead Casings. U.S. Patent No. 6038979. Inventors: Frew Watson, George Evans, John Hannick, Robert Lam.

Method for Using GUI Script and Providing a Universal Client Device. U.S. Patent No. 6043815. Inventors: Adam Simonoff, Larry Fontenot, Robert Taft, Brian McClintock.

Statistical Inference of Electromagentic Interferences Sources Based on A Priori Knowledge of Source and Receiver Parameters. U.S. Patent No. 6043770. Inventors: Adam Simonoff, Larry Fontenot, Robert Taft, Brian McClintock.

Synchro to Digital Converter. U.S. Patent No. 6069576. Inventor: William Gwin.

Universal Client Device for Operating any Two Computers. U.S. Patent No. 6078321. Inventors: Adam Simonoff, Larry Fontenot, Robert Taft, Brian McClintock.

Process for Making a Semiconductor Device with Barrier Film Formation Using a Metal Halide and Products Thereof. U.S. Patent No. 6077775. Inventors: Michael Strumborg, Tal Kin Chu, Francisco Santiago, Kevin Boulais.

Portable Launcher. U.S. Patent No. 6079310. Inventors: John Powers, Jon Yagla, Robert Lowry, Richard Miller.

Electronic Devices with Strontium Barrier Film and Process for Making Same. U.S. Patent No. 6083818. Inventors: Michael Strumborg, Tal Kin Chu, Francisco Santiago, Kevin Boulais.

A Universal Client Permitting a Computer to Receive and Display Information from Several Special Applications Simultaneously. U.S. Patent No. 6091412. Inventors: Adam Simonoff, Larry Fontenot, Robert Taft, Brian McClintock.

Operating Methods for Robust Computer Systems Permitting Autonomously Switching Between Alternative/Redundant Components. U.S. Patent No. 6125387. Inventors: Adam Simonoff, Larry Fontenot, Robert Taft, Brian McClintock.

Indian Head Division

Liquid Propellant. U.S. Patent No. 5972136. Inventor: Kerry Wagaman.

Airbag Propellant. U.S. Patent No. 6009810. Inventor: Christine Walsh.

Complexed Liquid Fuel. U.S. Patent No. 6110306. Inventor: John Consaga.

Variable Radar Altimeter Test Apparatus. Statutory Invention Registration (SIR) No. H1806. Inventors: Troy Ammons, Lawrence Miller.

Naval Undersea Warfare Center

Extendible Planar Phased Array Mast. U.S. Patent No. 5977918. Inventor: John E. Sirmalis.

System and Method for Processing Signals to Determine Their Stochastic Properties. U.S. Patent No. 5966414. Inventor: Francis J. O'Brien, Jr.

Site and Workspaces Layout Process Employing MDS a PDI Formula in Which Density Is Calculated Using Measured Span of Circumscribing-Convex-Hulls. U.S. Patent No. 6012036. Inventor: Francis J. O'Brien, Jr.

Mass Loaded Coating and Method for Reducing the Resonant Frequency of a Ceramic Disc. U.S. Patent No. 5973051. Inventor: Patrick J. Monahan.

Nose Cone and Method for Acoustically Shielding an Underwater Vehicle Sonar Array. U.S. Patent No. 5992077. Inventor: Neil J. Dubois.

Apparatus for Acoustically Isolating a High Pressure Steam Pipe in a Flooded Structure. U.S. Patent No. 6056019. Inventor: Neil J. Dubois.

Device for Machining an Interior Surface of a Tubular Object. U.S. Patent No. 6007278. Inventor: Donald Arsenault.

Belt Repair System and Method. U.S. Patent No. 5964018. Inventor: Paul E. Moody.

Dashpot for Power Cylinder. U.S. Patent No. 5992584. Inventor: Paul E. Moody.

Electrical Outlet Splash Protector. U.S. Patent No. 6050834. Inventor: Paul E. Moody.

Adjustable Side Piece for Glasses. U.S. Patent No. 6059411. Inventor: Paul E. Moody.

Adjustable Lifting and Precision Positioning Device. U.S. Patent No. 6059265. Inventor: Paul E. Moody.

Bellmouth Exit Angle Adapter. U.S. Patent No. 5996525. Inventor: Charles E. Gray.

Tapered Cylinder Electro-Acoustic Transducer With Reversed Tapered Driver. U.S. Patent No. 6002649. Inventor: Robert S. Janus.

Method for Irradiating Patterns in Optical Waveguides Containing Radiation Sensitive Constituents. U.S. Patent No. 5985523. Inventor: Scott L. Patton.

Geodetic Position Estimation for Underwater Acoustic Sensors. U.S. Patent No. 6028823. Inventor: Harold T. Vincent.

Switch Assembly for Withstanding Shock and Vibration. U.S. Patent No. 5969244. Inventor: Peter W. Machado.

System for Suppressing Cavitation in a Hydraulic Component. U.S. Patent No. 5996630. Inventor: Anthony A. Ruffa.

Multiline Tow Cable Assembly Including Swivel and Slip Ring. U.S. Patent No. 5983821. Inventor: Michael R. Williams.

Neural Network Based Contact State Estimator. U.S. Patent No. 6009185. Inventor: Christopher M. Deangelis.

Passive Surface Deployed Variable Inductance Wire Antenna. U.S. Patent No. 6025808. Inventor: Paul M. Mileski.

Apparatus and Method for Manipulating a Body in a Fluid. U.S. Patent No. 6029519. Inventor: Robert Kuklinski.

Method and Apparatus for Producing Gas Bubbles in a Liquid Medium. U.S. Patent No. 6039309. Inventor: Robert Kuklinski.

Classification System and Method Using Combined Information Testing. U.S. Patent No. 5999893. Inventor: Robert S. Lynch, Jr.

Method and Apparatus for Simulating Reverberation in a Multipath Sonar System. U.S. Patent No. 6002914. Inventor: Henry Weinberg.

Method and Apparatus for Simulating Multipath Sonar System. U.S. Patent No. 5995803. Inventor: Henry Weinberg.

Method and Apparatus for Simulating I, Lofargram in a Multipath Sonar System. U.S. Patent No. 5978646. Inventor: Henry Weinberg.

Method and Apparatus for Simulating Autocorrelation Coefficients in a Multipath Sonar System. U.S. Patent No. 5978647. Inventor: Henry Weinberg.

Method and Apparatus for Simulating Cross-Correlation Coefficients in a Multipath Sonar System. U.S. Patent No. 5983067. Inventor: Henry Weinberg.

Method of Predicting Steady Incompressible Fluid Flow. U.S. Patent No. 6009741. Inventor: Craig A. Wagner.

A Differential Hydrophone Assembly. U.S. Patent No. 6029113. Inventor: Roger L. Woodall.

System and Method for Calibrating Accelerometer Over Low (Ocean Wave) Frequencies. U.S. Patent No. 5970779. Inventor: David H. Shonting.

Method and Apparatus for Directing a Pursuing Vehicle to a Target With Intelligent Evasion Capabilities. U.S. Patent No. 6006145. Inventor: Anthony F. Bessacini.

A Bulkhead Penetrator and Method for Separating Cables From a Bulkhead Penetrator. U.S. Patent No. 6039324. Inventor: Gene J. Santa, Jr.

Standing Wave Plasma Antenna With Plasma Reflector. U.S. Patent No. 6046705. Inventor: Theodore R. Anderson.

Differential Calibration Signal Generator. U.S. Patent No. 6046632. Inventor: Timothy B. Straw.

Deployable Hull Array System. U.S. Patent No. 6039324. Inventor: Daniel M. Glenning.

Beam Pattern Shaping for Transmitter Array. U.S. Patent No. 5986972. Inventor: Peter C. Li.

Flow Control System Having Actuated Elastomeric Membrane. U.S. Patent No. 6024119. Inventor: Ivan N. Kirschner.

Countermeasure Flexible Line Array. U.S. Patent No. 6052332. Inventor: Robert J. Obara.

Multiple-Frequency Sonar System. U.S. Patent No. 6052335. Inventor: Kyrill V. Korolenko.

Shape Memory Alloy Activated Retractable Elastomeric Sealing Device. U.S. Patent No. 6019025. Inventor: Raymond A. St. Amand.

Torpedo Nose Lift Device. U.S. Patent No. 6053549. Inventor: William S. Wilkinson.

Velocity Reduction Method to Reduce the Flow Induced Noise of Towed Sensor Systems. U.S. Patent No. 6058072. Inventor: Bruce M. Abraham.

Fluid Propulsion Device for Use in a Projectile Launching System. U.S. Patent No. 6053157. Inventor: Thomas A. Frank.

Hybrid Neural Network for Pattern Recognition. U.S. Patent No. 6038338. Inventor: Chung T. Nguyen.

Fading Free Optical Phase Rate Receiver. U.S. Patent No. 6043921. Inventor: Robert M. Payton.

Baffled Muzzle Brake and Seal System for Submerged Gun Operation. U.S. Patent No. 5966858. Inventor: Clifford M. Curtis.

VXI Test Executive. U.S. Patent No. 5991537. Inventor: Brian T. Mckeon.

Mechanical Strain Relief. U.S. Patent No. 5975942. Inventor: Robert A. Roush.

System and Method for Stochastic Characterization of a Signal With Four Embedded Orthogonal Measurement Data Items. U.S. Patent No. 5963591. Inventor: Francis J. O'Brien, Jr.

Ballast System for Underwater Vehicle. U.S. Patent No. 6021731. Inventor: Daniel W. French.

Alignment Lifting Fixture. U.S. Patent No. 6030014. Inventor: John J. Vaillancourt.

Polarity Change Box for Radio Transmitter/Receiver. U.S. Patent No. 6011957. Inventor: Trevor L. Barron.

System for Verifying Nuclear Warhead Pre.Arm/Safing Signals. U.S. Patent No. 5971275. Inventor: David D. Schuller.

Method of Retrieving and Storing Computer Peripheral Data. U.S. Patent No. 6021431. Inventor: Paul J. Giorgio.

Method of Sensing Target Status in a Local Area Network. U.S. Patent No. 5991829. Inventor: Stephen J. Amuro.

Non-Intrusive SCSI Status Sensing System. U.S. Patent No. 6016506. Inventor: Stephen J. Amuro.

Propeller Assembly for an Underwater Device. U.S. Patent No. 6022193. Inventor: Neil J. Dubois.

Portable Optical Range Tracking Array. U.S. Patent No. 6002646. Inventor: Robert J. Reid.

Method for the Collection and Replay of Submarine Operational Data. U.S. Patent No. 6016453. Inventor: Joan M. Cembrola.

Sodium Hydroxide Compositions for Use in Battery Systems. U.S. Patent No. 6013192. Inventor: Steven P. Tucker.

Final Approach Trajectory Control With Fuzzy Controller. U.S. Patent No. 5987362. Inventors: Anthony F. Bessacini, Robert F. Pinkos

Multiple Tube Plasma Antenna. U.S. Patent No. 5963169. Inventors: Theodore R. Anderson, Victor K. Choo.

Water Impact Release Mechanism. U.S. Patent No. 6024326. Inventors: Daniel M. Godfrey, Gary R. Berlam.

Cavitation-Resistant Sonar Array. U.S. Patent No. 6050361. Inventors: Anthony A. Ruffa, Thomas R. Stottlemyer.

Multi-Layer Tiled Array. U.S. Patent No. 6046961. Inventors: Maurice J. Griffin, Fred Nussbaum, Gerald T. Stevens.

Fusing Contact Data for Best-Estimate Solution. U.S. Patent No. 6041019. Inventors: Neil A. Jackson, John T. Williamson, Francis J. Frantz, Patrick B. Ryll.

System and Method for Alignment of Stowage Drum Capstan in a Seagoing Vessel. U.S. Patent No. 6055739. Inventors: Victor J. Marolda, Louis E. Sansone.

Optimizing the Rotational Speed of Cooling Fans. U.S. Patent No. 5963887. Inventor: Paul J. Giorgio.

Conformal Detachable Platform Array. U.S. Patent No. 5964175. Inventors: John E. Sirmalis, Bernard J. Myers.

Telemetry System Using Broadband Correlation Techniques. U.S. Patent No. 6020830. Inventors: James M. Gannon, Robert M. Payton.

SCSI Controller With Target Status Retrieval. U.S. Patent No. 6076102. Inventors: Paul J. Giorgio, Stephen J. Amuro.

Underwater Mine Placement System. U.S. Patent No. 6112667. Inventors: Vernon Bailey, Edward J. Hilliard, Jr.

Actuated Recoil Absorbing Mounting System for Use With an Underwater Gun. U.S. Patent No. 6116136. Inventors: Ivan N. Kirschner, Gary R. Berlam.

System and Method for Tracking Vehicles Using Random Search Algorithms. U.S. Patent No. 6115700. Inventors: David J. Ferkinhoff, Kai F. Gong, Sherry E. Hammel.

Grommet Having Metal Insert. U.S. Patent No. 6114629. Inventors: Robert A. Roush, David L. Bartlett, William T. Young, Jr., Austin H. Wolfe.

Site Workspaces Layout Process Employing MDS and a PDI Formula in Which Density Is Based on Area of Circumscribing-Convex-Hulls. U.S. Patent No. 6112184. Inventor: Francis J. O'Brien, Jr.

Tombstone Mounted, Torpedo Tube Flow Control Valves. U.S. Patent No. 6079347. Inventor: George W. Lieb.

Modifying the Operational Center Frequency of an Array. U.S. Patent No. 6088298. Inventor: Tamer B. Onat.

Isolated Compensated Fluid Delivery System. U.S. Patent No. 6111187. Inventor: Aime B. Goyette.

Isolation System for a High Pressure Steam Pipe in a Flooded Structure. U.S. Patent No. 6,105,429. Inventor: Neil J. Dubois.

Captive Soft Foam Shock Mount System. U.S. Patent No. 6082698. Inventor: Neil J. Dubois.

Wake Bubble Coalescing System. U.S. Patent No. 6123044. Inventor: Robert Kuklinski.

Bubble Manipulating System and Method of Using Same to Produce a Solid Mass With Embedded Voids. U.S. Patent No. 6065949. Inventor: Robert Kuklinski.

Soft-Bodied, Towable, Active Acoustic Module. U.S. Patent No. 6088296. Inventors: Peter E. Seaman, Thomas R. Stottlemyer, Norman Toplosky, Anthony A. Ruffa.

Time Synchronization Algorithm for Massively Parallel Processor Systems. U.S. Patent No. 6098178. Inventors: David J. Moretti, John A. Fitzgerald

Wavelet-Based Hybrid Neurosystem for Classifying a Signal or an Image Represented by the Signal in a Data System. U.S. Patent No. 6105015. Inventors: Chung T. Nguyen, Sherry E. Hammel, Kai F. Gong.

Interlink for Spatially Extended Hydrophones. U.S. Patent No. 6118733. Inventor: Gregory H. Ames.

Directional Heat Exchanger. U.S. Patent No. 6059017. Inventor: Riad Sayegh.

Assembly and Method for Positioning a Measurement Probe Proximate a Test Body Disposed for a Fluid Tunnel Test. U.S. Patent No. 6058769. Inventors: Pierre J. Corriveau, Richard E. Dooley, Stanley Polhemus, William S. Wilkinson.

Semi-Rigid Low-Noise Interlink for Spatially Extended Hydrophones. U.S. Patent No. 6111820. Inventor: Gregory H. Ames.

Reduced Mechanical Coupling Interlink for Spatially Extended Hydrophones. U.S. Patent No. 6111819. Inventors: Antonio L. Deus Iii, Gregory H. Ames, Paul D. Curry.

Real-Time Acquistion. U.S. Patent No. 6115681. Inventors: Carl R. Foreman, Joseph B. Lopes, Gerald R. Martel.

Reconfigurable Multiple Component Load Measuring Device. U.S. Patent No. 6105438. Inventor: Thomas J. Gieseke.

Radio Frequency Communications for Underwater Vehicle. U.S. Patent No. 6058874. Inventors: Daniel M. Glenning, Michael Visich.

Autonomous Undersea Platform. U.S. Patent No. 6118066. Inventors: John E. Sirmalis, Pamela J. Lisiewicz.

Broadband Direct-Fed Phased Array Antenna Comprising Stacked Patches. U.S. Patent No. 6118406. Inventor: Michael J. Josypenko.

Propeller Deflection Snubber. U.S. Patent No. 6109985. Inventors: Neil J. Dubois, Robert J. Obara.

Underwater Deployable Testing Platform. U.S. Patent No. 6085683. Inventors: Daniel W. French, John J. Vaillancourt, Robert N. Carpenter, Richard R. Shell.

Acoustic Sound Speed Profiling System. U.S. Patent No. 6088297. Inventor: Thomas R. Stottlemyer.

Presettable Launchable Vehicle System and Method. U.S. Patent No. 6067851. Inventors: Robert J. Chaves, Charles Ferreira, Jr.

Large Panel Surface Planer. U.S. Patent No. 6068036. Inventor: James Cassidy.

Acoustically Driven Plasma Antenna. U.S. Patent No. 6087992. Inventor: Theodore R. Anderson.

Plasma Antenna With Electro-Optical Modulator. U.S. Patent No. 6087993. Inventors: Theodore R. Anderson, Robert J. Aiksnoras.

Variable Integration Detection Apparatus and Method for Multipath Environments. U.S. Patent No. 6122224. Inventor: Robert C. Higgins.

Fluid Conduit. U.S. Patent No. 6106236. Inventors: Charles W. Henoch, Peter J. Hendricks.

Mounting Assembly for Rigidly Integrating a Component Therewith. U.S. Patent No. 6077111. Inventors: Peter W. Machado, Edward C. Baccei.

Tow Cable With Conducting Polymer Jacket for Measuring the Temperature of Water Column. U.S. Patent No. 6072928. Inventor: Anthony A. Ruffa.

Horizontal Plasma Antenna Using Plasma Drift Currents. U.S. Patent No. 6118407. Inventor: Theodore R. Anderson.

Ship Ceremonies

Ship Ceremonies in 2000— Keel Laying, Naming, Christening, and Commissioning.

January
8 USNS *Pililaau* (T-AKR 304), Christening

March
25 *Iwo Jima* (LHD 7), Christening

June
24 *Bulkeley* (DDG 84), Christening
24 USS *Tornado* (PC 14), Commissioning

July
2 *McCampbell* (DDG 85), Christening
4 *Zumwalt* (DD 21), Naming
28 USNS *Watkins* (T-AKR 315), Christening

August
19 USS *Oscar Austin* (DDG 79), Commissioning

October
14 USS *Roosevelt* (DDG 80), Commissioning
19 USNS *Mary Sears* (TAGS 65), Christening

November
1 USNS *Impeccable* (T-AGOS 23), Christening
15 *Cutthroat* (LSV 2), Christening

December
8 *San Antonio* (LPD 17), Keel Laying

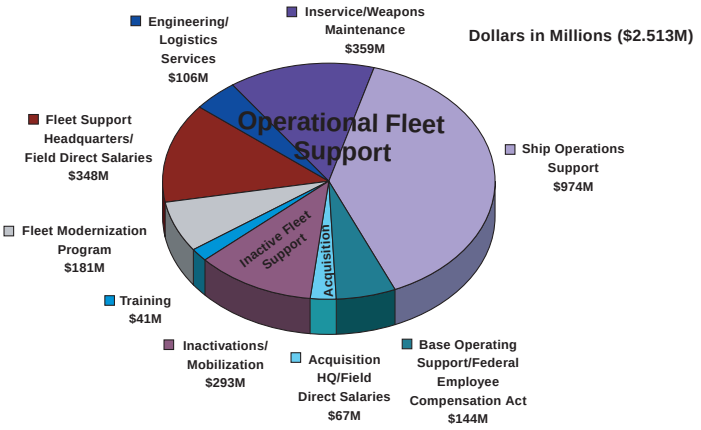
Navy Ship Construction—New Starts

Fiscal Year 2001 President's Budget*

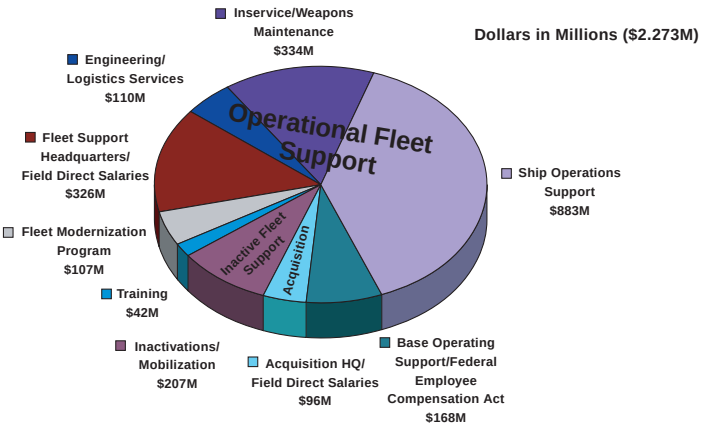
Ship Class	FY99	FY00	FY01	FY02	FY03	FY04	FY05
CVN Replacement			1				
SSN *774* (*Virginia* Class)	1		1	1	1	1	1
CVN Refueling				1			
Submarine Refueling			1	1	2	1	2
DD-21							1
DDG 51 (*Arleigh Burke* Class)	3	3	3	2	2	2	1
LHD 1 (*Wasp* Class)							1
LPD 17	1	2	2	2	2	2	
Oceanographic Ship	1						
T-ADC(X)		1	1	3	3	2	2
JCC(X)						1	1
SUBTOTAL, Navy Ship Construction	6	6	9	10	10	9	9
National Defense Sealift Fund	2	1					
SUBTOTAL, Major Ships	8	7	9	10	10	9	9
Service Craft						5	5
LCAC Service Life Extension Program		2	1	2	3	3	4
TOTAL	8	9	10	12	13	17	18

* These Fiscal Year 2001 figures represent tentative construction. Approval of the President's Fiscal Year 2002 Budget is pending.

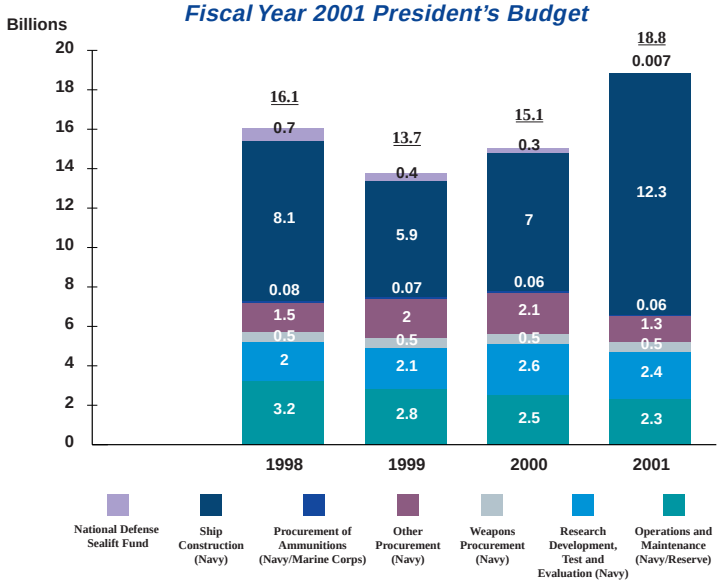
Fiscal Year 2000 Naval Sea Systems Command Operations and Maintenance (Navy) Support to the Fleet Fiscal Year 2000 Close Out



Fiscal Year 2001 Naval Sea Systems Command Operations and Maintenance (Navy) Support to the Fleet Fiscal Year 2001 President's Budget



Naval Sea Systems Command Fiscal Year 2001 President's Budget



Note: Figures for future fiscal years beyond Fiscal Year 2001 are unavailable pending approval of the President's Fiscal Year 2002 Budget.

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